LITERATURE OF MANUFACTURERS

Catalogues, bulletins and other direct advertising material recently issued.

Manufacturers are requested to send copies of new trade literature promptly to Electric Refrigeration News.

Belding-Hall

Catalog No. 28 issued by the Belding Hall Co., Belding, Mich., describes its line of refrigerators, display cases and market coolers for hotels, restaurants, delicatessen shops, groceries and meat markets. Materials, construction and air circulation are discussed in the forepart of the catalog. Photographs of twenty-five refrigerators finished in oak, three all-porcelain refrigerators, two walk-in coolers and a display case are contained in the catalog.

Bryant

A folder issued by the Bryant Electric Refrigerator Corp., New Milford, Pa., describes its line. Ten models in the Bryant line of cabinets are shown, one has interior finish of enamel and exterior finish of lacquer, five have porcelain interiors and lacquer exteriors and four are all-porcelain models. The food storage capacities in these models range from 5 cu. ft. to 15 cu. ft. Photographs of two condensing units are contained in the folder. Model A, with one cylinder has an ice melting capacity of 145 lbs. in 24 hours and the other Model F, with two cylinders has an ice melting capacity of 400 lbs. Four cooling units are also shown. These have ice cube capacities ranging from 56 to 180 cubes.

Electric Refrigeration Supplies Co.

The line of refrigeration accessories carried by the Electric Refrigeration Supplies Co., 51 Barclay St., New York, N. Y., is described in its catalog. This line includes gauges, thermometers, belts, piston and sleeve rings, gaskets, carbon motor brushes, motors, motor parts, gas masks, sulphur dioxide, refrigeration oil, brass and copper tubing, brass tube fittings, brass pipe fittings, valves, flaring tool, tube cutter, can tops and hooks, lid rings, wire, switches, armored cable and electrical fittings.

Gurney Ball Bearing

The Gurney Ball Bearing division of the Marlin-Rockwell Corp., Jamestown, N. Y., has issued a handbook aiding engineers in the selection and application of Gurney ball bearings. The single row deep groove type, radio thrust type, duplex type, double row type and lubri-seal type bearings are described in the handbook. A number of line drawings are included to illustrate the mechanism and operation of the bearings. A section is devoted to engineering data and this includes several tables and methods for computing loads on bearings. The care of bearings is also discussed. This section treats with the removal and cleaning of bearings, keeping out dirt and grit, mounting on shaft and in housing, lubrication and other general hints.

Frigidaire

Fourteen Frigidaire models with food capacities ranging from 4 cu. ft. to 18 cu. ft. are described in a booklet issued by the Frigidaire Corp., Dayton, Ohio. Seven models have porcelain-enamel finish exteriors and interiors of seamless porcelain enamel, and seven have exteriors of duco on steel and interiors of seamless porcelain-enamel. All models are equipped with TF coils and have ice cube capacities from 24 to 144 cubes. Photographs of eight cooling coils and two condensing units, Model EF and Model A, both air cooled units, are shown. Food preservation and the operation of the new cold control are also discussed in the booklet.

Hussmann-Ligonier

The new Hussmann quick service display counter is described in a catalog issued by the Harry L. Hussmann division of the Hussman-Ligonier Co., St. Louis, Mo. This counter has three inch cork insulation in the base and two inch cork insulation for the back wall of the bunker compartment. It is equipped with a riffle pan to prevent drying out of meats and outside illumination. A line drawing shows a cross-sectional view of the counter and the air circulation within.

Norge

A small folder offered by the Norge Corp., Detroit, contains a description of Model 300, which was recently added to the Norge line. This is a self-contained model and is equipped with a 1-6 hp. motor. This model has a food capacity of 4 cu. ft. and is designed for installation in small homes and apartments.

Robinson

The Robinson Refrigerator Works, Chicago, Ill., has sent in a catalog showing its line of Steelclad refrigerators for ice and mechanical refrigeration. Two models insulated with corkboard and designed for installation with self-contained units are shown, along with two cabinets having heights of 36 in. respectively which are designed for installation in kitchenette apartments. All cabinets are arranged to accommodate any standard refrigerating coil.

Sparklets, Inc.

The operation of the Sparklets syphon is described in a folder issued by Sparklets, Inc., New York, N. Y. Thirty-five recipes for making various kinds of ice cream, sherbets and beverages are also included in the booklet. A section is also devoted to a number of general hints on using the syphon.

Universal Cooler

Photographs of sixteen Universal cooler cabinets are contained in a folder sent in by the Universal Cooler Corp., Detroit. These models are designed for installation in apartments and homes and have food capacities ranging from 4 cu. ft. to 15 cu. ft. Three methyl chloride condensing units equipped with motors of ¼, 1/3 and ½ hp. are also illustrated.

Zerozone

A complete line of commercial refrigerating equipment is announced in a folder which is published by the Iron Mountain Co., Chicago, Ill. Twenty-seven types of cooling coils for commercial installations are illustrated. These include a number of full fin type coils. Photographs of seven condensing units equipped with motors ranging from 1/6 to 1½ hp. and a cross sectional view of a compressor are also included.

Welsbach Refrigeration Keeps Flowers and Fruit Fresh in Toronto Station

The Chas. Cira florist and fruit shop in the main lobby of the Toronto, Ontario, union station, is equipped with a Eureka display case, manufactured by the Eureka Refrigerator Co., Owen Sound, Ontario, and refrigerated by a Welsbach super freezer evaporator. The installation was made by the M. S. Gooderham Sales Co., Toronto distributors for the Welsbach Co.

NEW DEALERS & DISTRIBUTORS

Recent appointments announced by manufacturers and new sales outlets reported from the field.

Copeland

Distributors:
- Carnegie Electric Co., 10012 Carnegie Ave., Cleveland, Ohio.
- Radio Electric Co., Springfield, Ohio.
- Copeland Electric Refrigeration Co., 2508 Washington Ave., Newport News, Va.
- Copeland Refrigeration Co. of Roanoke, Inc., 315 Campbell Ave. W., Roanoke, Va.
- R. B. Alling Co., 3390 Cass Ave., Detroit, Mich.
- Scotland Neck Furniture Co., Scotland Neck, N. C.
- Binder Electric Co., 1846 Broad St., Trenton, N. J.

Dealers:
- Fred Gifford & Son, Chittenango Station, N. Y.
- Gander Electric Co., Albany, N. Y.
- Millner Electric Co., 130 Cedarhurst Ave., Cedarhurst, N. Y.
- R. K. Caldwell, Lake George, N. Y.
- E. C. Teft, Stillwater, N. Y.
- Rey Ben Radio Shop, Church St., Hoosick Falls, N. Y.
- H. W. Phillips, Glens Falls, N. Y.
- O. W. Collins, Argyle, N. Y.
- H. A. Scott, Whitehall, N. Y.
- Smith Hunt, Cato, N. Y.
- Belden & Edwards, Port Henry, N. Y.
- J. W. Ward & Son, Belton Landing, N. Y.
- J. E. Callahan, Big Moose, N. Y.
- Samuel Mulwitz & Sons, Port Chester, N. Y.
- Rhoades Electric Co., Valejo, Calif.
- Turner Hardware & Implement Co., Turlock, Stockton, Oakdale, Hughson, Lodi, Tracy, Manteca, Ripon and Escalon, Calif.
- Thomas Furniture Co., Grass Valley, Calif.
- John Breuner, Stockton, Calif.
- Penn Radio Electric Co., 1006 Penn Ave., Wilkinsburg, Pa.
- James Spear Stove & Heating Co., 1823 Market St., Philadelphia, Pa.
- W. C. Powell, Lansdowne, Pa.
- Thompson's, 618 Sproul St., Chester, Pa.
- Edward Eyerman, Kingston, Pa.
- C. Markley, Harrisburg, Pa.
- Conneaut Lake Fuel & Supply Co., Conneaut Lake, Pa.
- Murphy's Jewelry Store, Maysville, Ky.
- Thompson Radio Co., Pineville, Ky.
- Bryant Bros., Mt. Vernon, Ky.
- John W. Hill, London, Ky.
- D. C. Craig, Stanford, Ky.
- R. L. Pollard, Jackson, Ky.
- Chlanda Harris Furniture Co., Longmont, Colo.
- Harris Inglefield Furniture Co., Greeley, Colo.
- Harris Warner Furniture Co., Ft. Collins, Colo.
- Red Cliff Furniture Co., Pueblo, Colo.
- Jennings Hardware Co., Jennings, Mo.
- Grand Sheet Metal Works, 1900 North Grand Blvd., St. Louis, Mo.
- Well Electric Appliance Co., 1460 Hodiamant Ave., St. Louis, Mo.
- N. P. Winters Electric Co., Webster Groves, Mo.
- Windsor Garage, Inc., Windsor, Conn.
- T. S. Bidwell Co., Windsor Locks, Conn.
- Charles Rice, Inc., 14 Haynes St., Hartford, Conn.
- Gail Radio Shop, Oklahoma City, Okla.
- Ford Bros. Hardware, Blackwell, Okla.
- Strickland Plumbing Co., Chickasha, Okla.
- Barden Remington Co., 115 Anawan St., Fall River, Mass.
- A. J. Normandeau Co., 259 Union St., New Bedford, Mass.
- F. R. MacIntosh Electric Co., 31 Oakland Ave., Pontiac, Mich.
- E. I. Henne, Saline, Mich.
- Nailon Bros., Inc., Peoria, Ill.
- Radio Sales & Service Co., Perry, Ill.
- Edward A. Lutz, Pawtucket, R. I.
- Wyllie Bros. Electric Co., 572 Smithfield Ave., Pawtucket, R. I.
- Paul & Penley, Augusta, Kans.
- McGregor Hardware, Winfield, Kans.
- Barris Bradshaw Furniture Co., Cheyenne, Wyo.
- Rinderspacher Steel & Rabe, Fremont, Nebr.
- Fred L. Sheler & Co., Richmond, Va.
- Dugan Bennett Implement Co., Watertown, S. D.
- Borstein Electric Supply Co., 918 Broadway, Camden, N. J.
- Grant & Winchel, Bangor, Me.
- Radio Supply Co., 1724 Charles St., Baltimore, Md.
- Exide Battery Co., Ranger, Tex.
- Mina Vulcanizing Shop, Mina, Nev.

Servel

Distributors:
- Electric Refrigeration & Appliance Co., Henderson, Ky. (Servel)
- Independent Electric Co., Muskegon, Mich. (Servel-Electrolux)
- A. A. Schneiderhahn Co., Des Moines, Iowa (Servel-Electrolux)
- Tovan Electric Co., 327 W. Third St., Cincinnati, Ohio. (Electrolux)

Dealers:
- Crystal City Gas Co., Corning, N. Y. (Electrolux)
- Elmira Water, Light & Railway Co., Elmira, N. Y. (Electrolux)
- Lynchburg Gas Co., Lynchburg, Va. (Electrolux)
- Mississippi Power & Light Co., Jackson, Miss. (Electrolux)
- Greenwood Gas & Fuel, Greenwood, S. C. (Electrolux)
- Sumter Gas & Power Co., Sumter, S. C. (Electrolux)
- Western Utilities Stores Co., Eureka, Anthony and Caldwell, Kans. (Electrolux)
- Northern Indiana Public Service Co., Lebanon, Ind. (Electrolux)
- Fremont Gas Co., Fremont, Nebr. (Electrolux)
- Anderson Gas & Utilities, Anderson, S. C. (Electrolux)
- Radio Shop, Florence S. C. (Servel-Electrolux)
- J. E. Miller, Bolivar, Pa. (Electrolux)

Norge

Distributors:
- McLaughlin Electric Supply House, Aberdeen, S. D.
- Service Supplies, Ltd., Ottawa, Ont., Canada.
- Northern Supplies, Ltd., North Bay, Ont., Canada.
- Benson Wilcox Electric Co., London, Ont., Canada.
- Standard Building Materials Co., Cleveland, Ohio.

"PLEASE CHANGE MY ADDRESS"

Recent movements of subscribers as indicated by changes in mailing addresses.

Allison Appliance Co., from 910 Francis Palms Bldg., to 10228 Woodward Ave., Detroit, Mich.

Baker, H. W., from 3710 Main St., to 6602 Avenue "F," Houston, Tex.

Bunn Electric Co., from 835 Baronne St., to 742 St. Charles St., New Orleans, La.

Carter, J. C., from 436 Chester St., to 543 E. Chestnut St., Lancaster, Pa.

Caswell, Lee, from 4132 Greenview Ave. to 120 S. La Salle St., Chicago, Ill.

Copeland Calif. Sales Inc., from 2228 W. Seventh St., to 216 Architects' Bldg., Los Angeles, Calif.

Cuthebert, J. W., from 86 Terrace Ave., Altadena, Calif., to 752 Glenview Road, Glendale, Calif.

De Mers, E. L., from Room 438, 608 S. Dearborn St., to Suite 669-71, 608 S. Dearborn St., Chicago, Ill.

Dickey, Chas. H., from 949 Mission St., to 417 Sutter St., San Francisco, Calif.

Goldfus, Chas., from 706 Queen Ave., to 3120 12th Ave., So., Apartment 105, Minneapolis, Minn.

Gray, John E., from 253 W. Grand Ave., to 1122 Lincoln Ave., Beloit, Wis.

Henninger, Lyle D., from 118 S. Eighth St., Olean, N. Y., to care of J. J. Fonuss, Allegany, N. Y.

Hubbs, L. A., from 60 California St., San Francisco, Calif. to Terminal Sales Bldg., Seattle, Wash.

Johnson, N. M., from 17110 3rd Ave., Highland Park, Mich., to 1532 Bewick, Detroit, Mich.

Milhon, J. M., from 2674 Cortland, Detroit, Mich. to 1373 Halmet St., Columbus, Ohio.

Moss, W. Hall., from 213 Main St., Greenwood, Miss., to 269 Union Ave., Memphis, Tenn.

Ortis, L. A., from 949 Mission St., to 417 Sutter, San Francisco, Calif.

Pizarro, Geo. R., from 630 Lycaste Ave., Detroit, Mich., to 422 W. 47th St., Kansas City, Mo.

Royal Refrig. Co., Inc., from 281 Powell St., to 131-151 North 14th St., Brooklyn, N. Y.

St. Louis Elect. Board of Trade, Carl H. Christine, Secy.-Mgr., 1042 Telephone Bldg., to 1504 Ambassador Bldg., St. Louis, Mo.

Stewart, D. C., from 4601 Chester Ave., Philadelphia, Pa., to 3215-6 35th St., Astoria, L. I., N. Y.

Strumpfler, Frank, from 1236 Bedford Ave., Brooklyn, N. Y., to 125-6 11th St., L. I. City, N. Y.

Thomas, C. C., from 630 Lycaste Ave., to 13503 Muirland Ave., Detroit, Mich.

Thompson, Vaughn W., from 125 S. Limestone St., to 22 W. Main St., Springfield, Ohio.

Via, E. Douglass, from 417 Martin-Brown Bldg., to 201 Martin-Brown Bldg., Louisville, Ky.

Wolf, Fred W., from 2440 Lake View Ave., to 2425 No. Halsted St., Chicago, Ill.

Zensen, H. A., Welsbach Co., from 3416 Texas Ave., to 2651-A Winnebago, St. Louis, Mo.

Portland Frigidaire Branch to Have New Building

Frigidaire Sales Corp., Portland, Oreg., has let the contract for a new three-story building. The building will be ready for occupancy early in July. It will be 10 feet by 82 feet and will be located at the east end of Burnside Bridge.

Electric Device Co. Takes Over G. E. Sales in Springfield

The Electric Device Co., 110 State St., Springfield, Mass., has taken over the retail store formerly conducted by W. E. Haskell, Inc., at 119 Dwight St., for the sale of General Electric refrigerators.

Fred E. Hazard Joins Meadows Mfg. Co. as Director of Sales

Fred E. Hazard, who was advertising manager of Servel, Inc., during 1925-1926, has been appointed director of sales of the Meadows Manufacturing Co., Bloomington, Ill.

Correction

On page 39 of the March 13 issue of the NEWS a caption appeared under a reproduction of two Brunswick-Kroeschell compressors describing one of the models as a "Twin cylinder sulphur dioxide unit." This should have read carbon dioxide instead of sulphur dioxide, as the Brunswick-Kroeschell Company does not include sulphur dioxide machines in its line.

THE CONDENSER

ADVERTISING RATE fifty cents per line (this column only).

SPECIAL RATE if paid in advance—Positions Wanted—fifty words or less, one insertion $2.00, additional words four cents each. Three insertions $5.00, additional words ten cents each. All other classifications—fifty words or less, one insertion $3.00, additional words six cents each. Three insertions $8.00, additional words sixteen cents each.

POSITIONS AVAILABLE

As manufacturers of household electrical refrigerators, with a program national in scope, several unusually attractive opportunities are available to men qualified to absorb their responsibilities.

Applications will be welcome from men experienced and intimately familiar with manufacturing and engineering problems of this industry. Likewise, men having taken student courses and familiar with shop activities relating to assembling, charging and testing of refrigerators.

Applications to be considered, must cover fully all details pertaining to age, personal description, married or single, training, experience, and study courses taken.

Applications will receive thorough and fair consideration, and to those that meet our standards of qualifications, a complete outline of opportunities will be sent. Box No. 156.

SALES MANAGER wanted to sell Royal meat choppers, coffee mills, coffee roasters, and meat slicers. Must be able to handle sales force. Only high pressure men need apply. Guaranteed territory, drawing account. Marsden's Store Fixture House, Inc., James Street, East Providence, R. I.

POSITIONS WANTED

FACTORY CONNECTION desired as field representative or zone manager. Five years as distributor, large territory, well known make electric refrigerator. Well grounded experience in sales and field work, domestic and commercial installations. Go anywhere. Address Box No. 151.

ENGINEER, 30, versed in Kelvinator, domestic, commercial and multiple refrigeration and in Servel-Electrolux gas refrigeration, desires new connection in Central South, if possible. Have eight years of very progressive, merchandising utility background and a complete knowledge of wiring. Box No. 155.

EXECUTIVE ENGINEER—Associated with electric refrigeration for the past ten years, seeks position with responsible corporation either in temporary or permanent capacity. Especially qualified to analyze and correct problems confronted with while in development stage or thereafter. Considered an authority on tooling up, production control and economy of operation. Box 157.

MISCELLANEOUS

REORGANIZATION — CAPITAL WANTED. Large Eastern manufacturer of household steel refrigerator cabinets; trade name nationally known; sold to department stores, dealers and manufacturers of electric iceless machines; constant demand during entire year; big profits; get in on the ground floor. Box No. 152.

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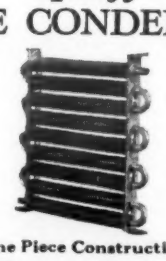
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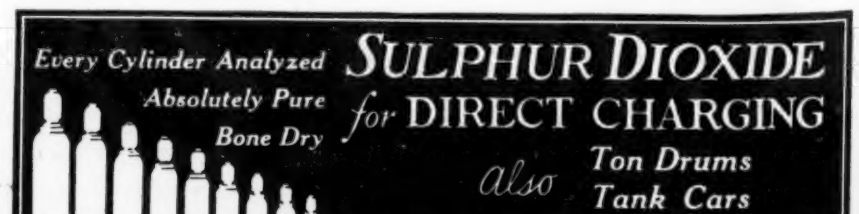

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Please enter subscription to Electric Refrigeration News.

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ELECTRIC REFRIGERATION NEWS

The business newspaper of the refrigeration industry

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COPELAND PRODUCTS SHOWS NET EARNINGS OF $201,694 FOR 1928

Ratio of Assets to Liabilities Is Now Three to One

COPELAND Products, Inc., Detroit, reports net earnings for 1928, after all reserves, of $201,694.67, equivalent to $1.98 per share on the company's outstanding "A" stock.

Highlights of the annual statement as pointed out by William Robert Wilson, chairman of the board, in a letter to stockholders were an increase in ratio of assets to liabilities to 3 to 1 from 2.7 to 1; an increase of $108,681.44 in working capital; an increase of $40,874.73 in cash on hand; deferred charges reduced by $9,596.84.

Contingent liabilities of the company as endorser on notes and contracts discounted for distributors, decreased $149,955.83 to $35,692.91. Mention is made of the fact that while 1928 shipments showed a 42% increase, selling costs were reduced over 50%. Export business more than doubled, the Copeland product is now being sold in 21 foreign countries.

According to Mr. Wilson, the 1929 outlook for the company is very bright, current operations being indicated by an increase in March shipments of 50% over March of last year. A considerable portion of this increase he attributes to the recent introduction of a full line of commercial and apartment house units to complement the comprehensive line of household equipment which has been increased to include three distinct lines of electric refrigerators catering to the low priced, medium priced and high priced fields.

Copeland Products has outstanding 101,992 shares of "A," and 231,782 shares of "B" or common stock, both classes being of no par value. The "A" stock, which is non callable, is entitled to dividends of $2.50 when declared, and shares equally with the common in all dividends declared above that amount. Both stocks are listed on the Detroit Exchange. The "A" stock is also listed and dealt in on the New York Curb Exchange.

REGULAR PRODUCTION OF INDIAN MACHINES SCHEDULED FOR JULY 1

To Make Machines Only; Plan 5,000 Units This Year

REGULAR production of the new Indian refrigerator, produced by the Indian Motocycle Co., Springfield, Mass., will start July 1, according to an announcement by Louis E. Bauer, president. The company will offer the refrigerating unit only, leaving the choice of cabinet to the distributor.

Production plans call for 5,000 refrigerating units this year. Sales for this year will be confined to Springfield, Boston, New York, Chicago and Detroit. A firm that distributes Indian motorcycles in New York City has placed an order for 1,000 and small orders have been received from Detroit and elsewhere.

The unit is manufactured complete in the Indian plant with the exception of the motor, which is obtained from the Westinghouse Electric & Manufacturing Co., and the thermostat, the make of which has not been definitely determined.

The first 300 units, made for experimental use and put into Seeger cabinets, have been sold. As a result of a careful check made on the operation of machines in use in Springfield and vicinity the company has formulated plans for regular manufacture.

The refrigerating unit, employing a rotary compressor, is located at the top of the cabinet, leaving generous storage space below. The reduction of moving parts to a minimum, with no speed-reduction mechanism and absence of vibration, is regarded as a strong point on the ground of quietness of operation and also durability, and the small size of the mechanical unit makes for easy handling and convenience in servicing. A new arrangement of ice trays enables a few cubes to be removed as desired without disturbing the rest. Economical use of electricity, due to simplicity of construction, is stressed as a selling point.

Cabinets made for the first 300 machines were of two sizes, the larger being 28 inches wide, 27½ inches deep and 67 inches high, and the smaller 24 inches wide, 27½ inches deep and 64 inches high.

Treasure Chest and Salesman In Costume Forecast Presentation of New G. E. Model at Portland

The opening of the General Electric treasure chest in Portland, Ore., was heralded by trucks of the Arch Electric Refrigeration Co., distributors of General Electric refrigerators, which paraded through the principal streets of Portland. Salesmen in costume depicted characters of pirate days.

Mayor George L. Baker of Portland, presided at the opening of the chest on March 22, at which time the new model G-40 General Electric refrigerator was revealed to the public. Poster cutouts of pirates and novel lighting effects in the window display were used.

$5,000,000 CONTEST BETWEEN CHICAGO & NEW YORK G. E. MEN

Rex Cole and Dick Cooper Rivals

TWO General Electric refrigerator distributing organizations, Rex Cole, Inc., New York, N. Y., and R. Cooper, Jr., Inc., Chicago, Ill., are vying for honors in a $5,000,000 contest which was inaugurated on March 25 between the two organizations. The contest will end at midnight, June 1, and the quotas of the rivaling distributors are as follows: Rex Cole, Inc., $2,625,000 and R. Cooper, Jr., Inc., $2,375,000.

The contest will be symbolized as a race between two railroad trains, one known as the "Dick Cooper Express" will travel from Chicago to New York. The other known as the "Rex Cole Limited" will travel from New York to Chicago. Each train is made up of four sections, namely, apartment house section, retail section, commercial section and wholesale section. Each department manager in the two organizations is acting as a conductor and is responsible for maintenance of train schedule along the route. The railroad will be known as the Cole-Cleveland-Cooper all steel line and Rex Cole and R. Cooper, Jr. are occupying the cabs in the locomotives. Salesmen will be the only passengers on the imaginary train and each week the leading refrigerator salesmen will be awarded places in the cars, such as drawing room, compartments, lower and upper berths in the pullman. The only fuel used will be orders for refrigerators and the trains will move toward their respective destinations according to the total amount of business booked by each distributor.

Each week mileage coupons will be awarded to salesmen and dealers of both concerns. These coupons may be redeemed during the contest. Two hundred and fifty prizes valued at $10,000 are being offered as inducements to the salesmen and dealers. A three-foot silver loving cup will be awarded to the winning distributor. This trophy will be presented at Association Island, N. Y., at the 1929 convention.

The contest executive committee is composed of members of both organizations with A. C. Mayer, manager of the merchandising division of the electric refrigeration department of the General Electric Co. acting as chairman of the arbitration committee. Richard Cooper, Jr., is chairman of the Chicago division of the contest committee which is composed of H. D. Laidley, C. G. Rood, J. S. Duncombe, H. W. Gifford, L. C. Kohlman, F. J. Mackie, L. A. McKenzie, E. W. Parish and E. G. Cloud. Rex Cole heads the New York contest committee which is composed of R. Stevenson, E. H. Campbell, M. E. Pipkin, J. J. Massimi, P. H. Hichborn, D. F. Secord, L. H. Jenks, Jr., F. W. Beck and W. Fisher.

AMERICAN INSTITUTE OF REFRIGERATION TO MEET IN WASHINGTON, MAY 2-3

The American Institute of Refrigeration will hold its annual meeting in Washington, D. C., May 2 and 3, at the Washington Hotel, according to an announcement by Louis Baron, executive secretary.

EARL LINES IN CHARGE OF KELVINATOR ADVERTISING

EARL LINES, for the past three years advertising and sales promotion manager of the Leonard Refrigerator Co., Grand Rapids, Mich., has been appointed director of advertising and sales promotion of the Kelvinator Corporation, Detroit, succeeding J. A. Corcoran, who has been appointed manager of the New York branch of the Kelvinator Sales Corporation. This announcement is made by Henry W. Burritt, vice-president in charge of sales.

Mr. Lines is president of the Advertising Club of Grand Rapids, and chairman of the Fifth District of the International Advertising Association, which includes Michigan, Ohio, West Virginia, and parts of Kentucky and Indiana. The Leonard Refrigerator Co., of which he was advertising and sales promotion manager, is the cabinet division of Kelvinator Corp.

In his previous business connections Mr. Lines was for three years advertising manager of the Rex Manufacturing Co. and for four years advertising manager and cashier of the Fayette Bank and Trust Company.

STARR NAMED HONORARY MEMBER OF THE A.S.R.E.

John Edwin Starr will be formally elected the first honorary member of the American Society of Refrigerating Engineers at a luncheon meeting at the Engineers' Club, New York City, April 13.

Mr. Starr was nominated as an honorary member by sixty-two members on Jan. 23. He was elected on a ballot by the Council March 8.

Mr. Starr was the first president of the Society, serving from Dec. 5, 1904 to Dec. 4, 1905. The luncheon in his honor was arranged by a special committee under the chairmanship of Dr. F. B. Churchill, and the committee on the Twenty-fifth Anniversary, to be celebrated in December 1929.

Presentation of the certificate will be made by Arthur J. Wood, president of the Society, and tribute to Mr. Starr will be made by Peter Neff.

REORGANIZATION OF ABSOPURE COMPANY IS RESULT OF SUIT

Absopure Refrigeration Corp. Buys Two Divisions of General Necessities

DAVID A. Brown, president of the General Necessities Corp., Detroit, announces the formation of the Absopure Refrigerator Corp., which, within the past week has purchased the Absopure Frigerator Co., Detroit, and the Vogt Refrigerator Co., Louisville, Ky., both divisions of the General Necessities Corp.

The new concern is a Michigan corporation with 200,000 shares of preferred stock, $10.00 par value, and 1,100,000 shares of no par value common stock. The General Necessities Corp. owns a substantial interest in the new corporation and the management will be in the hands of those men who have been with the Absopure Frigerator Co. during the past five years. Officers of the new corporation are as follows: David A. Brown, president; Harry J. Redwood, vice-president; E. E. Von Rosen, secretary and treasurer. The directors are J. H. Nugent, I. C. Brown, Harry C. Hayes, M. C. Burnside, Thomas Pendergast Harry Z. Brown, Thomas Moran and Peter J. Terns.

In commenting on the reorganization, David A. Brown stated, "The growth of our refrigeration business made it the outstanding division of the General Necessities Corp. and with this growth and expansion came the need for a greatly increased financial structure.

"It was decided to form a new corporation, merge the Absopure Refrigerator Co. and the Vogt Refrigerator Co. and offer the public 400,000 shares of the new corporation's no par value stock. The sale of this stock will provide the necessary capital to carry out the large program of expansion which has been held in abeyance for some time, awaiting the outcome of the recent patent suit.

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COMING ISSUES—April 24—Industrial refrigeration equipment, material handling and delivery equipment. May 8—Refrigerator cabinets, gas refrigeration. May 22, June 5, June 19—Annual N. E. L. A. convention numbers.

GENERAL MEETING OF MANUFACTURERS' COUNCIL APRIL 16

Executives Representing Ten Companies to Act on Group Plan to Promote Dealer Interests

EXECUTIVES representing member companies of the Refrigeration Manufacturers' Council will meet at the Hotel Statler in Detroit, Tuesday, April 16 at 10 A. M. to take action on a cooperative program which has been under consideration for several months.

Important phases of the plan include the fostering of local organizations of distributors and dealers in the principal cities and a study of the conditions affecting the profitable operation of retail stores. Discussion at preliminary meetings has indicated a general agreement that profitable operation by the dealer represents an objective toward which group effort may be directed most effectively and that research of an unbiased character will be necessary to determine the facts on which constructive measures may be based.

Marshall T. Jones, chief of the Electrical Equipment Division of the Department of Commerce, Washington, D. C., will be present at the meeting to confer with the Council on the collection of industry statistics and other opportunities for cooperation with the Department of Commerce.

The following companies will be represented at the meeting:

General Electric Co.
Kelvinator Corp.
Servel, Inc.
Copeland Products, Inc.
Norge Corp.
General Necessities Corp.
Climax Electrical Refrigeration Co.
Universal Cooler Corp.
Peerless Ice Machine Co.
Holmes Products, Inc.

Invitations have been extended to a number of other manufacturers producing domestic and commercial equipment and it is probable that the membership of the Council will be increased by action at this meeting.

Temporary headquarters of the Council have been established at the offices of Electric Refrigeration News in Detroit and the details of the organization's affairs will be directed by F. M. Cockrell until such time as a permanent executive secretary is selected.

PHILADELPHIA A.S.R.E IS GRANTED CHARTER BY PARENT CHAPTER

Nominating Committee Appointed Frigidaire Film Shown

ANNOUNCEMENT was made at a meeting of the Philadelphia temporary section of the American Society of Refrigerating Engineers, April 5, that a charter had been granted by the parent organization.

A meeting for organization will be held early in May. H. I. Lewis, sales manager of the American Engineering Co., acting as temporary chairman, appointed the following members to act as a nominating committee to submit names for the offices of president, vice president, and secretary and treasurer: Wayne Barker, Hess & Barker, chairman; W. S. Gibbs, refrigerating engineer, American Engineering Co.; and J. A. Morash, electric refrigeration sales division, Philadelphia Electric Co.

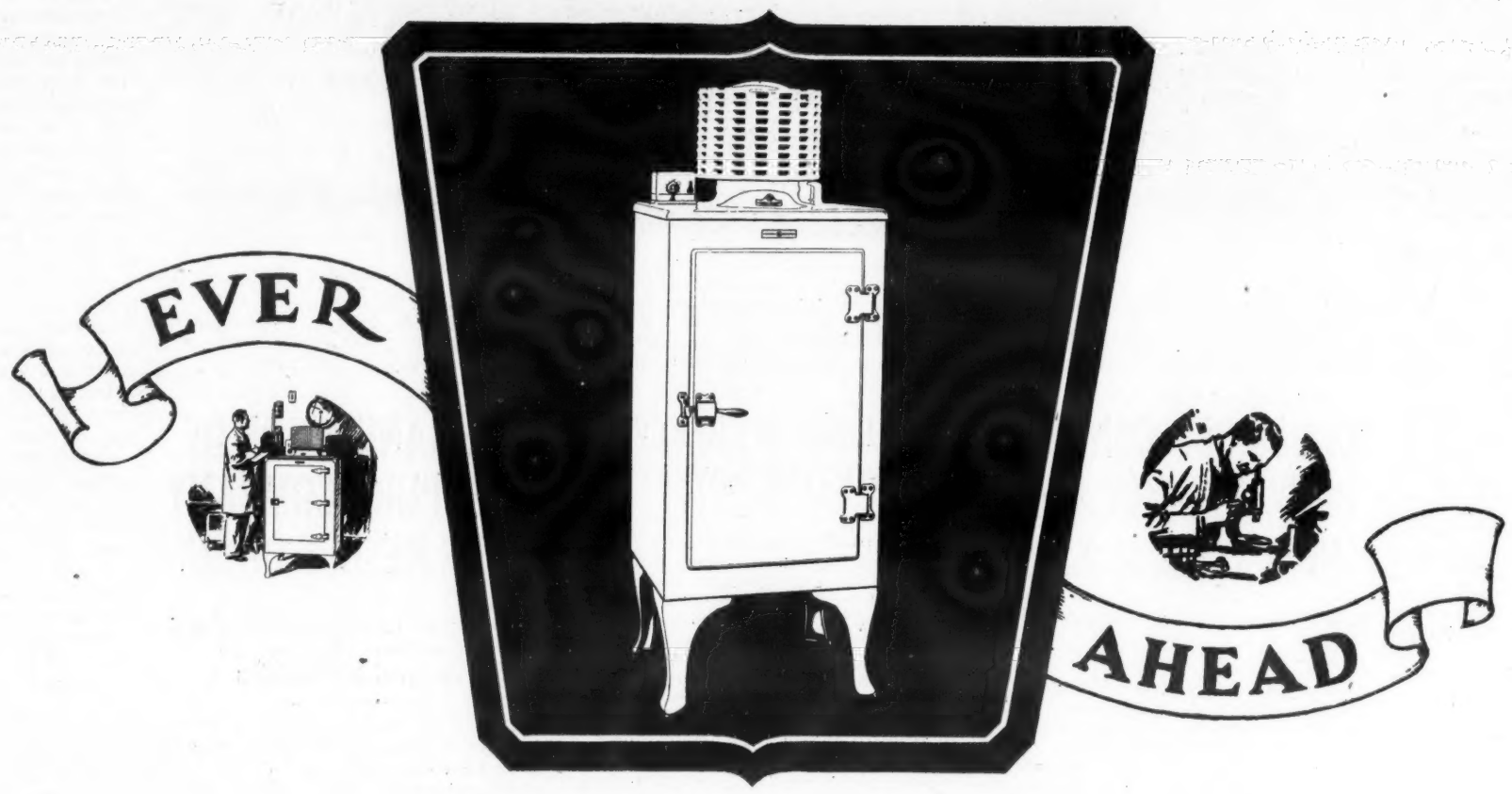
Mr. Lewis has served as temporary chairman for the three meetings held and Cyril Leech, Mack Machine Co., as secretary-treasurer.

Following the dinner and business session, Frank R. Pierce, sales manager of the J. J. Pocock Co., Frigidaire distributor, showed two reels of motion pictures of the factory at Dayton. J. P. Galloway, regional manager for Frigidaire, made a short talk, saying his company wished to cooperate with the A. S. R. E.

H. M. Edwards, Cork Insulation Co., Inc., 154 Nassau St., New York City, talked on cork as insulation. Mr. Edwards explained that cork trees are usually 30 years old before the bark is taken from them and the second cutting is made 10 years later. After the talk Mr. Edwards answered many questions on cork.

Mr. Lewis predicts that the membership will be approximately seventy-five.

General Electric Refrigerators have always embodied *these important advantages*



THE outstanding merit of the General Electric Refrigerator was universally recognized the very day it was first announced. Its introduction completely revolutionized the art of refrigeration. This refrigerator—the product of fifteen years of intensive research and development—embodies the vital features listed below:

....an hermetically sealed, dust-proof mechanism.
....an easily accessible temperature control.
....a mechanism that requires no oiling.
....all troublesome machinery eliminated.
....a new standard of quiet operation.
....mounted on legs with broom-room underneath.
....no installation problem whatever.
....a sanitary, porcelain chilling chamber.
....the entire mechanism mounted on top.
....absolutely no radio interference.
....maximum food storage space in the cabinet.
....an appreciably lower cost of operation.
....a radically improved type of cabinet.
....an unqualified two-year service guarantee.

Recently announced is the new warp-proof all-steel cabinet, an exclusive General Electric feature now available in the small family model.

These advantages, tested and proved by thousands of enthusiastic owners, have brought an enviable position of leadership to General Electric Refrigerators and to its distributors and dealers.

GENERAL ELECTRIC
ALL-STEEL REFRIGERATOR

REFRIGERATION DEPARTMENT, GENERAL ELECTRIC COMPANY, HANNA BUILDING, CLEVELAND, OHIO

FRIGIDAIRE ENGINEERS DISCUSS COMMERCIAL REFRIGERATION SALES

SIXTY refrigeration engineers of the Frigidaire Corp. from every section in this country and parts of Canada attended a three day meeting which was held at the Engineers' Club in Dayton on March 25-27. Commercial refrigeration was discussed at the meeting and the problems pertaining to its sale and installation were explained by various Frigidaire officials.

D. H. Theobald, sales engineer, was the principal speaker at the opening day's session and discussed the various types of commercial refrigeration equipment which have been developed to meet the growing demand. E. J. Barney, of the material control division, explained why the filling of special orders at the factory takes a longer time than the production of standard products.

At the Tuesday afternoon session R. E Robillard, of the sales engineering department, spoke on water coolers, apartment house installations and the new Frigidaire products. Architects' problems in connection with refrigeration and water cooling in buildings were discussed by S. M. Schweller, of the engineering department. Other speakers at the various sessions were J. A. Harlan, sales manager; R. J. Richards, head of the sales educational department, and H. S. Turner, assistant service and installation manager.

The engineers visited the Moraine plant on Monday afternoon and after dinner at the plant they examined the work of the research rooms. On Tuesday evening the Frigidaire Corp. was host at a dinner at the Van Cleve Hotel. R. D. Funkhouser, vice president of Frigidaire Corp.; F. L. Lee, head of the sales promotion department, and other officials addressed the engineers at the banquet.

STANDARDS ASSOCIATION APPROVES REFRIGERATOR STANDARDIZATION WORK

The scope of the work being undertaken in respect to standardization of refrigerators, which is under the joint sponsorship of the Bureau of Home Economics of the Department of Agriculture and the American Society of Refrigerating Engineers, was approved as follows by the Standards Council of the American Standards Association, New York, at its December meeting: (a) Inside cubic contents. (b) Area and spacing of shelves. (c) Dimensions of ice doors. (d) Co-operation with the Division of Simplified Practice in establishing outside dimensions. (e) The development of such standard methods of test as will be necessary to establish the data required in determining the rating of refrigerators. (f) Specifications covering the more important data essential to the rating of refrigerators and appropriate for inclusion on a name plate defining the leading characteristics of the box. (g) The setting up of standard grades and qualities for refrigerators. (h) Due consideration of questions of ruggedness and durability.

Such standards and specifications are to apply both to refrigerators cooled with ice and to self-acting or mechanical refrigerators employing a self-contained refrigerant. They are also to apply to household types of refrigerators and to such domestic type refrigerators as are used in hospitals and hotels, but not to ice making machinery or other specialized types of equipment.

AUTHENRIETH ESTIMATES POWER CONSUMPTION OF REFRIGERATION MACHINES

Annual Consumption of Small Units Is 630,000,000 kw.-hr.

The importance of refrigeration as an electric power load was emphasized by A. J. Authenrieth, vice-president of the Middle West Utilities Co., Chicago, Ill., before the Mid-West Power Conference held in Chicago, Feb. 12-16. In domestic and small commercial refrigeration 900,000 units are in use, he reported. At an annual consumption of 700 kw.-hr. per unit the annual use of energy is 630,000,000 kw.-hr.

Ice production in the United States, he reported, during 1928 approximated 72,000,000 tons, of which 61,000,000 tons were manufactured. The total number of ice plants in this country is about 7,000, of which 32 per cent are steam driven, 59 per cent driven by electricity and 9 per cent use gas and oil engines. If production divides itself according to the number of plants, then 36,000,000 tons were produced by electricity. Using a figure of 62 kw.-hr. per ton, the power consumption by ice manufacturers during 1928 totaled 2,232,000,000 kw.-hr.

A large amount of power is also used by cold storage plants, Mr. Authenrieth declared. On the basis of 731,377,000 cu. ft. of storage space in this country, assuming that electricity is used in the same proportion as in the manufacture of ice; namely, 59 per cent, and using the rate of 60 kw.-hr. per 1,000 cu. ft. per month, the energy consumed by cold storage plants would amount to 310,688,000 kw.-hr. annually. The 17,993 dairy, ice cream and food process plants which are electrically equipped consume about 584,575,200 kw.-hr. per year.

DRY ICE CORP. EXTENDS ACTIVITIES IN FLORIDA

Manufacture of dry ice will be begun in Jacksonville, Fla., by May 15, according to an announcement by A. V. O'Connor, southeastern representative of the Dry Ice Corp. of America, New York City.

More than $100,000 in equipment is to be added to the local plant of the Liquid Carbonic Corp., says Mr. O'Connor. This announcement followed a recent visit of officials of the Dry Ice Corp., including August Herksher, chairman of the board; Robert R. Rust, president; and P. F. Lavender, vice president in charge of sales.

In connection with the announcement, Francis R. Mason, associated with the operations of Mr. Herksher in the southeastern territory, stated: "The move into Florida is the result of numerous queries of the Dry Ice Corp., I am informed, from shippers of varied commodities. The organization, from what I have gathered, is looking forward to a more diversified use of dry ice throughout this state than in other sections."

Under present plans, according to Mr. O'Connor, this is one of two dry ice plants to be established in the southeast by this corporation, the other at Atlanta. Mr. O'Connor says use in both cases will be made of available equipment of the Liquid Carbonic Corp.

H. W. FOULDS BROADCASTS TALK TO SERVEL SALES CONFERENCE IN BOSTON

Servel Sales, Inc., held a sectional sales convention, sponsored by the C. C. Harvey Co., metropolitan distributors, in Boston recently. More than 175 dealers were present. H. W. Foulds, vice-president in charges of sales, broadcast a talk from Evansville, which was received in the banquet room at the meeting.

Vernon E. Vining, sales manager of Servel Sales, Inc., gave a talk and as a demonstration of the sturdiness of the Servel refrigerator had three men with sledge hammers attempt to break up a model on display.

Attending the convention were F. G. Parker, zone supervisor; W. G. Stevens, New England district sales manager; R. K. Eskew, and George R. Copeland, Servel engineers; A. T. Golding, sales promotion manager, and William Reynolds, advertising manager.

42 STATIONS BROADCAST G. E. PROGRAMS IN U. S.

A net work of 42 stations has been engaged by the General Electric Co. to broadcast a weekly program to all parts of the United States. Outside the United States, WGY's two short wave stations W2XAF and W2XAD carry the program to South Africa, South America, Australia, and Europe, which assures the General Electric hour being heard practically all over the world.

The NBC red net work broadcasts the General Electric hour in the United States. The programs are presented from New York City and the electric refrigeration department is being featured at various times during the broadcasting plan.

A. A. H. UHALT TO ASSIST G. E. DEALERS WITH SALES PROBLEMS

The appointment of A. A. H. Uhalt to assist dealers and their salesmen with sales problems has been announced by A. C. Mayer, manager of the merchandising division of the General Electric Refrigeration Department.

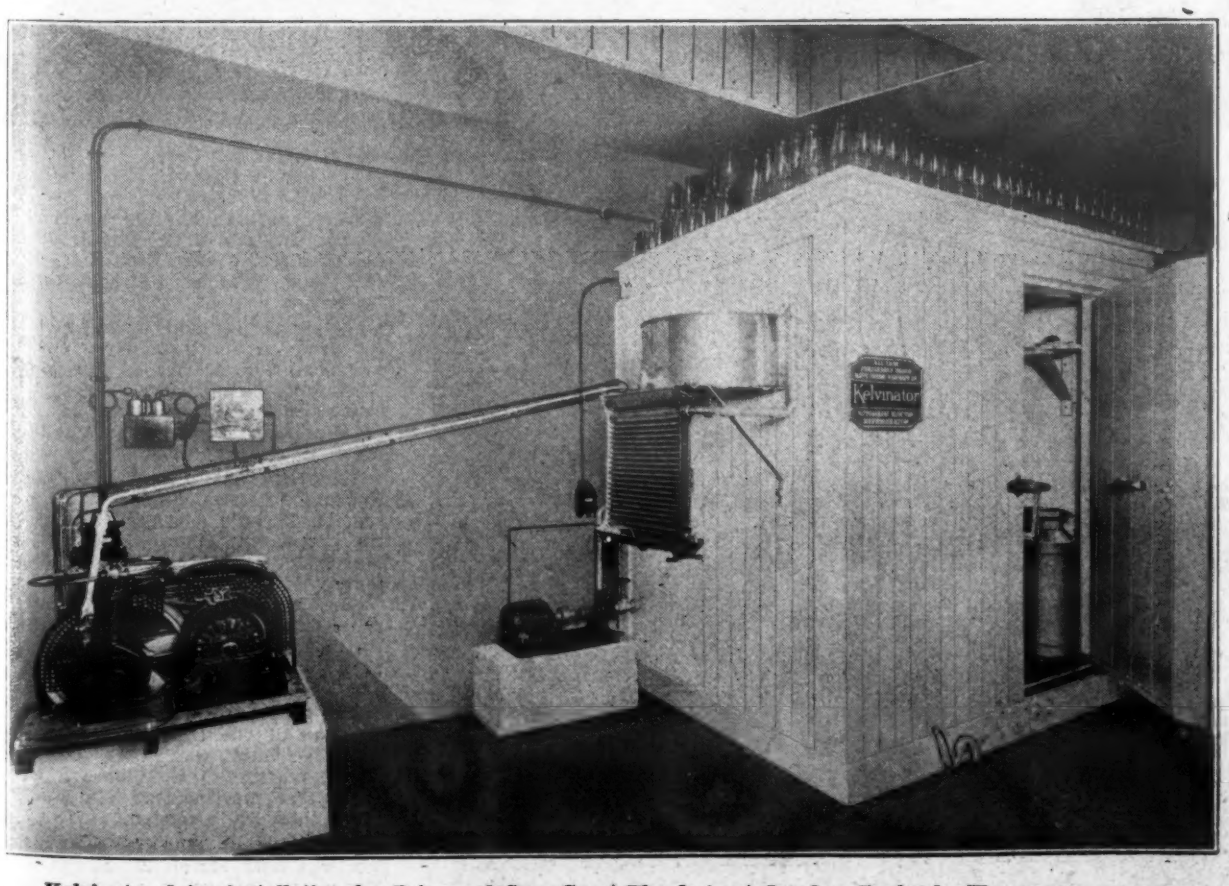
Mr. Uhalt was formerly with the United Fruit Co. installing General Electric equipment in South America. He later became General Electric refrigerator salesman for a utility company in Louisiana, then became a dealer in Monroe, La.

L. H. Gilmer Heads New Rubber Belt Concern

Ludwell H. Gilmer, founder and chairman of the board of the L. H. Gilmer Co., of Tacony, Philadelphia, Pa., has severed his connection with that company, except as a director, to head a new corporation for the manufacture of endless belts. The new company will be known as The Gilmer Corp. It will have headquarters in Detroit, with factory at Auburn, Ind., where it is planned to start production of automobile fan belts and other molded rubber products on April 15.

The Spotless English Dairy of Today

By Dorothy Dignam, European Correspondent



Kelvinator dairy installation for Price and Son, Great Bland street, London, England. The compressor serves a double purpose—cooling the warm milk and for cooling the storage room itself. Note the metal sign which the dealer is given for hanging in his window—"All our perishable foods kept fresh and safe in Kelvinator Automatic Electric Refrigerator."

Copeland
DEPENDABLE ELECTRIC REFRIGERATION

Broke all Sales Records in 1928!

Not only sales records were smashed by Copeland in 1928, but all existing Copeland records for *profits* were smashed as well! And 1929 will witness an even more sensational growth — March shipments this year were 50% greater than last year!

The reasons for this are obvious: a fast-growing preference for Copeland *Dependable* Electric Refrigeration, and a *complete line* with which to satisfy buyers in the domestic, multiple and commercial fields.

Copeland has a proposition which no distributor or dealer can afford to overlook. And Copeland is ready to present facts and figures that will surprise dealers and distributors who think they know all about the profits to be made from the sale of electric refrigeration.

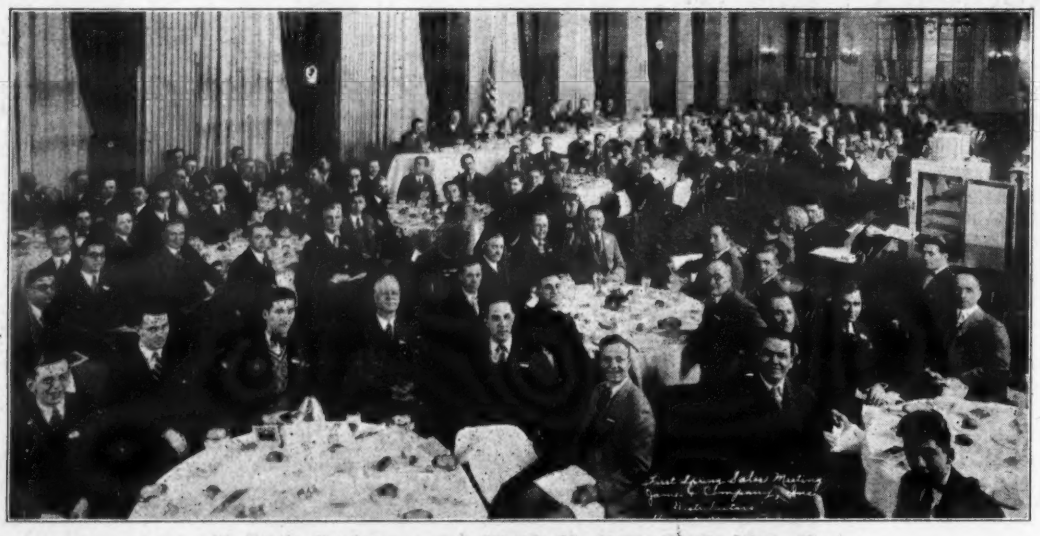
Some lucrative territories are still available to the right type of individual or group of individuals, and an exchange of information can do no harm. Write for full particulars to Copeland Sales Co., 630 Lycaste Ave., Detroit. Correspondence will be strictly confidential.

Copeland
DEPENDABLE ELECTRIC REFRIGERATION

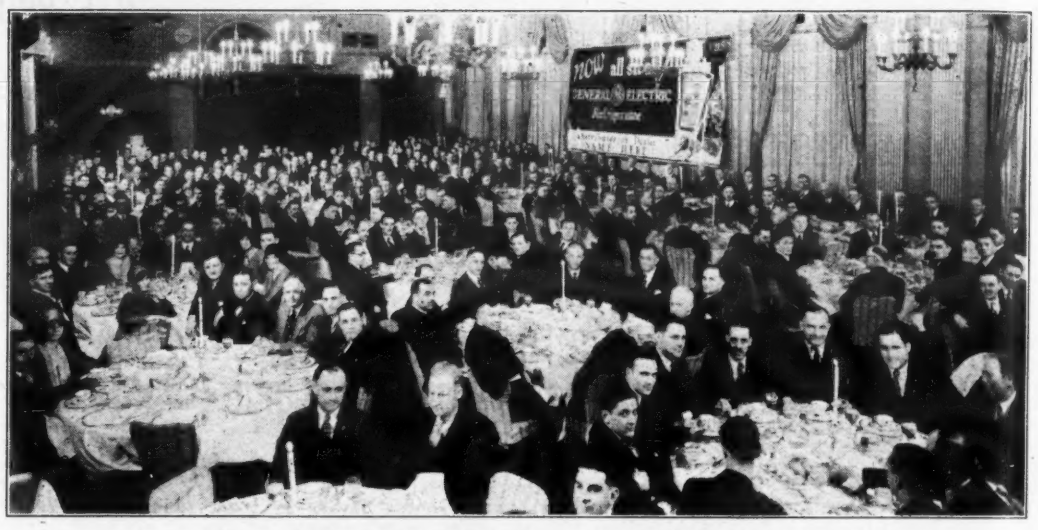
Spring Sales Conferences Of the General Electric Co.

General Electric Co., regional all-steel spring sales conferences were well attended throughout the country. Afternoon business sessions were held followed by banquets at which additional talks were given and other entertainment featured.

Dealers and salesmen of Rex Cole, Inc., New York metropolitan General Electric distributors, met at the Biltmore Hotel, New York City, March 21. Aproximately seven hundred dealers and salesmen attended.

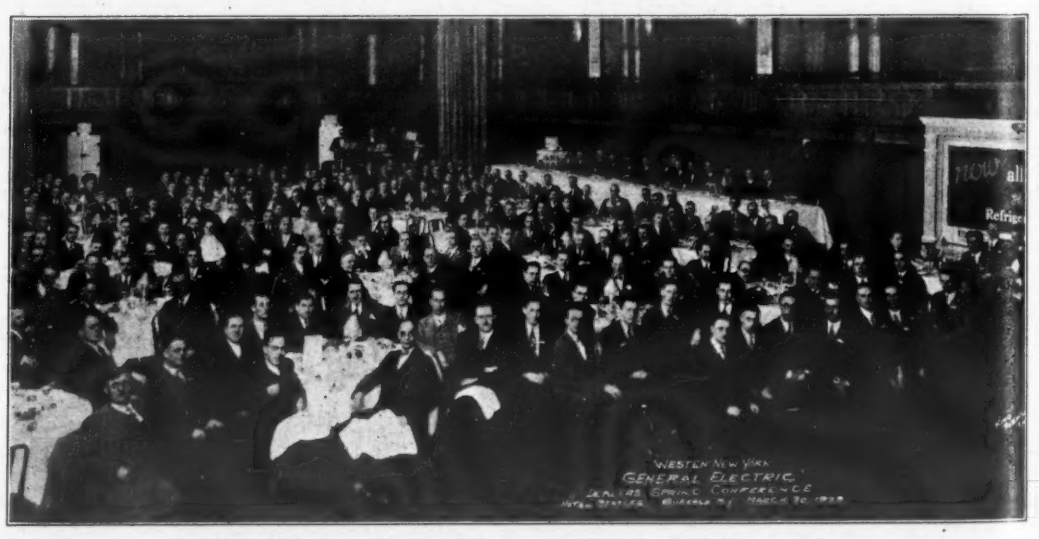


St. Louis Conference was March 12, James & Co., Inc., Hosts



Three Companies Cooperated in the Cleveland Meeting, March 16

Electric Refrigeration Co. of New England was Host in Boston, March 11



Buffalo Meeting with Erco, Inc., and Wheeler Refrigerator Corp.

HUNDREDS ATTEND ALL-STEEL SALES MEETINGS OF G. E.

The forty-four regional sales conferences of dealers, distributors, and salesmen of General Electric refrigerators, ended April 2. They were begun March 1 with a meeting at Toledo.

Officials of the company attended the different meetings and elaborate equipment was carried to conduct the conference and present sales messages. Special motion picture apparatus was carried and the operation of the new unit shown.

Officials of the company who spoke at meetings were: A. C. Mayer, G. C. Wasson, L. R. Edwards, W. J. Daily, F. M. Corliss, J. J. Donovan, W. E. Landmesser, W. M. Timmerman, A. R. Green, A. A. Uhalt, A. T. Taft, M. F. Mahoney and H. T. Hulett. W. E. Underwood, of Lord, Thomas & Logan, advertising agency handling the General Electric refrigerator account, was present at some of the meetings.

Among the meetings late in the schedule was the meeting of western New York

(Continued in column 5, this page)

R. Cooper, Jr., Inc., Dealers and Salesmen Met in Chicago, March 21

dealers and distributors at the Hotel Statler, Buffalo, N. Y., March 20. Hosts at the meeting were Erco, Inc., of Buffalo, and Wheeler Refrigerator Corp., Rochester.

Forty-eight attended a meeting of dealers from a southwestern Texas and southern New Mexico as guests of the E. O. Cone Co., distributors of that territory at El Paso, Tex., March 28. As part of the entertainment the guests were taken to Juarez, Mexico.

The Hines Co., Baltimore, and the National Electrical Supply Co., Washington, D. C., held a combined meeting at the Southern Hotel, Baltimore, Md., March 27. Total atendance was approximately 170.

One hundred forty-two dealers and representatives from utilities attended the regional sales conference held March 12 at the Statler Hotel, St. Louis, Mo. The meeting was with James & Co., Inc.

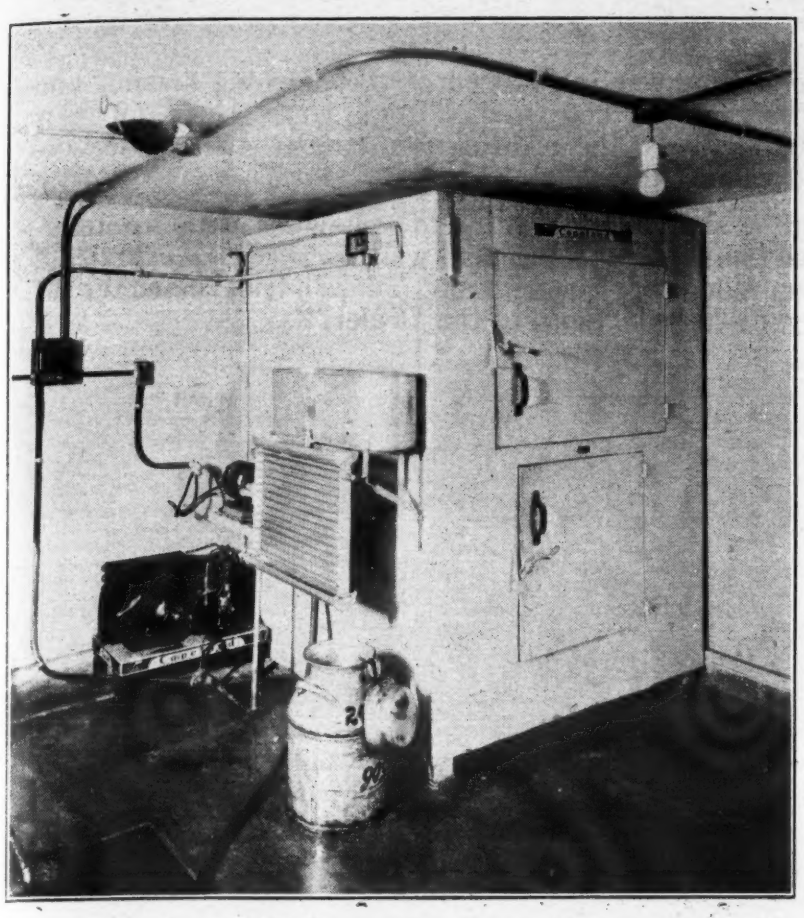
The Cleveland meeting was under the auspices of the Cushman Refrigeration Co., Cleveland, the H. G. Bogart Co., Akron, and the D. H. Willis Co., Canton, Ohio. The meeting was held March 16. More than 300 attended.

R. Cooper, Jr., Inc., Chicago distributor, was host March 21, at the Palmer House in Chicago to a large group of dealers and salesmen.

Approximately 550 executives, sales representatives of central stations, dis-

(Concluded on Page 15, Column 1)

Copeland Handles Milk Cooling Job in Wisconsin Dairy



A milk cooler installation has just been made at the dairy farm of T. A. King at Big Bend, Wis., by the Copeland Refrigeration Co. of Milwaukee. This installation consists of a specially built brine storage tank which is mounted in the upper compartment of the milk storage refrigerator, cooling the refrigerator and furnishing the cold brine for the aerator mounted on the side. The condensing unit is a Copeland ½ hp. air cooled machine.

H. J. JENKINS TO BE APARTMENT HOUSE SPECIALIST WITH G. E.

The appointment of H. J. Jenkins as apartment house specialist has been announced by J. J. Donovan, manager of the apartment house division of the General Electric refrigeration department, Cleveland. Mr. Jenkins was formerly with the distributor organization of R. Cooper, Jr., Chicago.

Two Long Beach, Calif. Men Named Members of Frigidaire Quota Club

Taskar P. Dubose and G. W. Pratt, Long Beach, Calif., were awarded a purse of $100 in gold at the Pacific coast Frigidaire regional meeting held in San Francisco on March 14. They were also made members of the Frigidaire Quota Club because of their sales record during the past year in Long Beach territory.

V. B. Carr Named Sales Manager of Evansville G. E. Firm

V. B. Carr has been appointed sales manager of the Electric Refrigerator Co., Evansville, Ind., General Electric distributor for southern Indiana and Illinois, and western Kentucky. Mr. Carr was formerly with the Williams Automatic Oil Corp. at Columbus, Ind.

Copeland Unit Used at Cooking School Held at Atlanta

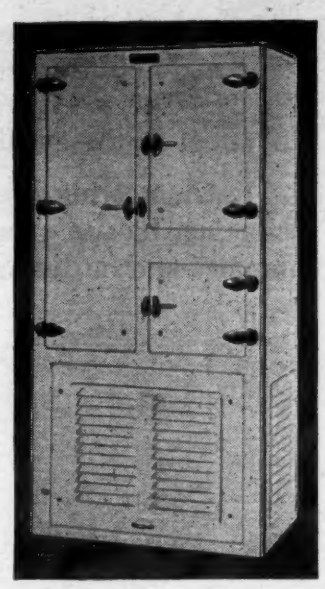
Copeland electric refrigeration is being used in a cooking school conducted at Atlanta, Ga., under the direction of the Atlanta Georgian-American, by Mrs. Francis Northcroff, well-known home economist. Arrangements for using a Copeland unit were made through the Sterchi Furniture & Carpet Co., Copeland distributors at Atlanta.

A National Acceptance

The gratifying reception that has been accorded the NEW BOHN SANITOR series is undoubtedly due to its low price — but by no means to price alone, for in every detail of its construction BOHN standards have been adhered to rigidly. Here is a super-quality, all-porcelain refrigerator that is as beautiful in appearance as it is efficient in service. Quantity production brings its price within the reach of the majority of families in your community.

These models together with those of the other famous BOHN Lines combine to make a group of refrigerators that answer every requirement in style, size and price.

Our catalog gives complete information and it is yours for the asking.



Nothing finer can be said of a refrigerator than "It was built by BOHN."

BOHN REFRIGERATOR COMPANY
SAINT PAUL, MINNESOTA

NEW YORK CHICAGO BOSTON

G. E. HOLDS COMMERCIAL MANAGERS' CONFERENCES

The first commercial managers' conference was held at the Refrigeration Institute of the General Electric refrigeration department, Cleveland, March 4, 5 and 6.

A second conference was held March 11 to 13 and another is to be held April 15 to 17.

Commercial managers of distributor organizations throughout the country attended these meetings which were held under the auspices of the commercial division of the electric refrigeration department. Plans for commercial sales and new commercial models were subjects of the discussions.

REID-BISHOP INC. OPENS NEW RETAIL STORE IN FORT WORTH

Opening of the "treasure chest" and the presentation of the new all-steel General Electric refrigerator at Fort Worth on Mar. 27 also marked the opening of a new retail store at 805 Lamar St. by Reid-Bishop, Inc., distributors in Texas.

The wholesale offices of the company will remain at 1501 Fort Worth National Bldg. C. E. Reid and R. S. Bishop are officers of the concern which has more than 100 General Electric refrigerator dealers representing it in 40 counties in Texas.

AMERICAN ENGINEERING CO. APPOINTS CUBAN DISTRIBUTOR

Jose L. Villaamil & Co., Havana, Cuba, has been appointed to handle the Juruick line of refrigerating machines, according to the American Engineering Co., 50 Church St., New York.

Belmont Corp. Appointed Holmes Distributor in Four States

The Belmont Corp. of Minneapolis and St. Paul, Minn., has been recently appointed distributors for the Holmes electric refrigerator in Minnesota, North and South Dakota and the bordering counties of Wisconsin. Officers of the Belmont Corp. are George A. Michel, president, Clarence B. Michel, vice-president, and Henry J. Michel, secretary.

O. Bohny Joins Sales Departments of Dallas Electrolux Firm

O. Bohny, formerly manager for the Electric Refrigerating and Appliance Company of Dallas, Texas, for four years, is now connected in sales work with Penniman, Inc., distributors of Electrolux refrigerators at 3919 Gaston Ave., Dallas, Texas.

SAVAGE ANNOUNCES TWO CHANGES IN PERSONNEL

The Savage Products Distributing Corp., Utica, N. Y., subsidary of the Savage Arms Corp., announces that William L. Howlett, manager of the New England district with headquarters in Boston, Mass., has been transferred to Chicago, where he will succeed Robert S. Sturgis, as manager of the North Central district. Mr. Howlett was connected with the Chicago office prior to his removal to Boston.

W. L. Howlett

John M. Matteson, who has been assisting Mr. Howlet in the New England district, will succeed him as manager. He was formerly located at Utica.

H. G. VENEMANN JOINS FRICK; WITH PITTSBURGH BRANCH

H. G. Venemann has joined the Frick Co., Inc., Waynesboro, Pa., and will be connected with the Pittsburgh branch office. He was formerly sales manager of the Baker Ice Machine Co., Omaha, Nebr., and for the past several years, until Jan. 1 of this year, was eastern district manager for the Omaha concern.

H. A. Connor Named Supervisor of Frigidaire Enameling Dept.

Henry A. Connor of the Frigidaire Corp., Dayton, Ohio, has been promoted to supervisor of the enameling department to fill a vacancy left by V. W. Jared. Mr. Connor was formerly assistant to Mr. Jared, who is now district engineer with the Sherman Engineering Corp., industrial engineers.

Kelvinator Equipment Installed In Long Beach Delicatessen

R. L. Darby, Long Beach, Calif., has installed Kelvinator equipment in Bernstein's new delicatessen and restaurant located on Pine St. in Long Beach. This order included a large refrigerator and two 16-foot refrigerated counters.

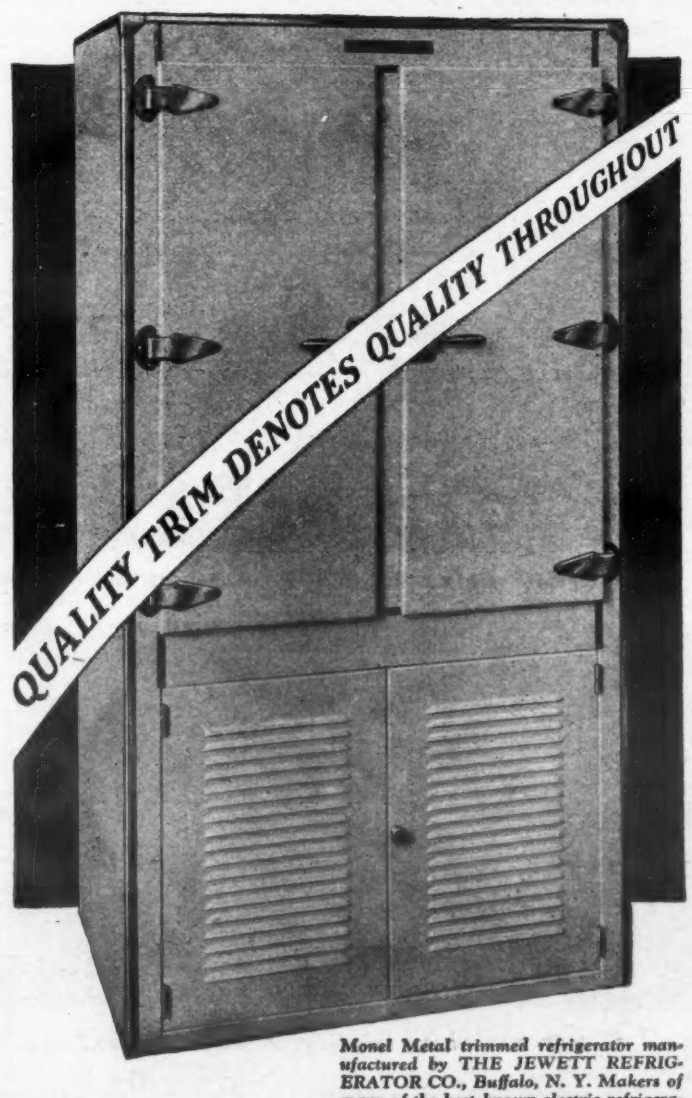
A *new influence...* on quality refrigerator sales

Color advertising featuring . . . . . Monel Metal trim

MILLIONS of The Saturday Evening Post and Good Housekeeping readers each month are being impressed with the superior properties of Monel Metal when used for refrigerator trim and other household equipment.

This national advertising in color is directing the attention of five million of the nation's best homes to the fact that the silvery beauty of Monel Metal lasts for years...that clean-looking Monel Metal harmonizes with present-day color schemes ...that modern Monel Metal makes good housekeeping easier.

Now is the opportune time for manufacturers of quality refrigerators to reap the benefits of Monel Metal's increasing nation-wide popularity. Ask us to send you complete information about Monel Metal and about our cooperative plan for equipment manufacturers. Write today.



Monel Metal trimmed refrigerator manufactured by THE JEWETT REFRIGERATOR CO., Buffalo, N. Y. Makers of many of the best known electric refrigerators have adopted Monel Metal for trim.

See our exhibit at the National Electric Light Association Convention, Municipal Auditorium, Atlantic City, New Jersey. June 3rd to 7th inclusive. Space Nos. 375 and 377.

MONEL METAL
MODERN AS TOMORROW

Monel Metal is a technically controlled Nickel-Copper alloy of high Nickel content. It is mined, smelted, refined, rolled and marketed solely by The International Nickel Company, Inc. The name "Monel Metal" is a registered trade mark.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

MONEL METAL

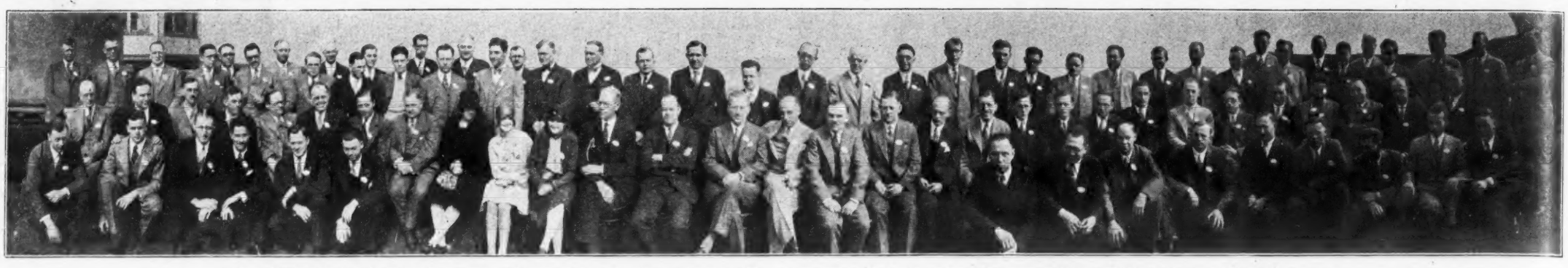
KELVINATOR REGIONAL SALES CONFERENCES

The series of twenty-one regional sales conferences beginning Feb. 8 and held throughout the country by Kelvinator Corp., closed Feb. 27. The meetings were all one-day conferences, closing with a banquet in the evening.

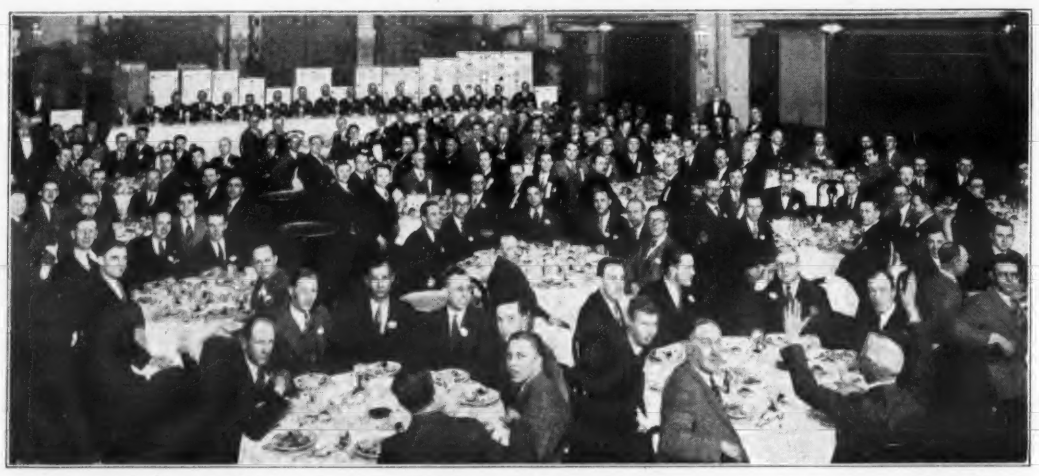
Each meeting was opened by the district sales manager introducing, by use of a movie, the heads of the departments of the company and outlining the duties of each.

The domestic line was introduced at the morning session and the refrigeration market discussed. Talks were given on new manufacturing methods, the utilities department, the service department, and cabinet division.

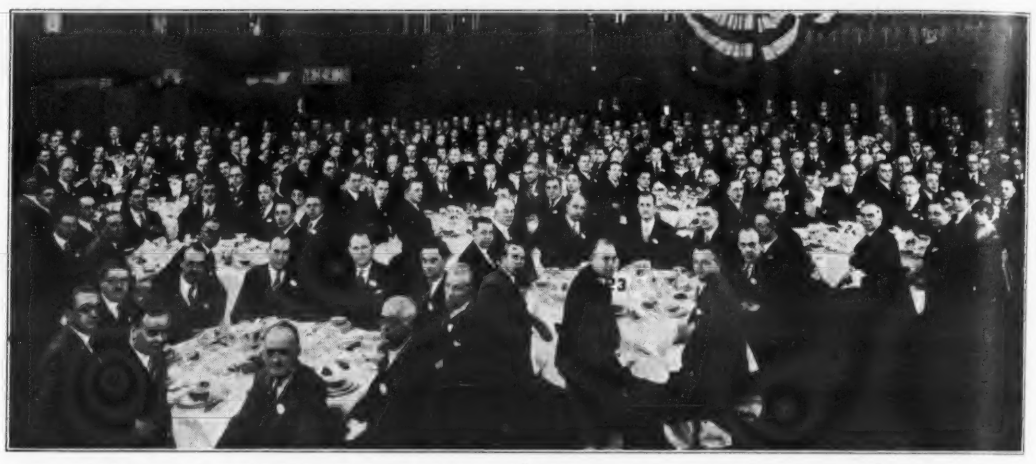
Afternoon sessions were devoted to a showing of the commercial line. Kelvinator's financing plan was discussed. Advertising and sales promotion were considered. The district manager of each territory discussed "Serving the Dealer."



The Kelvinator regional sales convention for the San Francisco territory was held Feb. 16 under the supervision of Wm. E. Day, district manager.

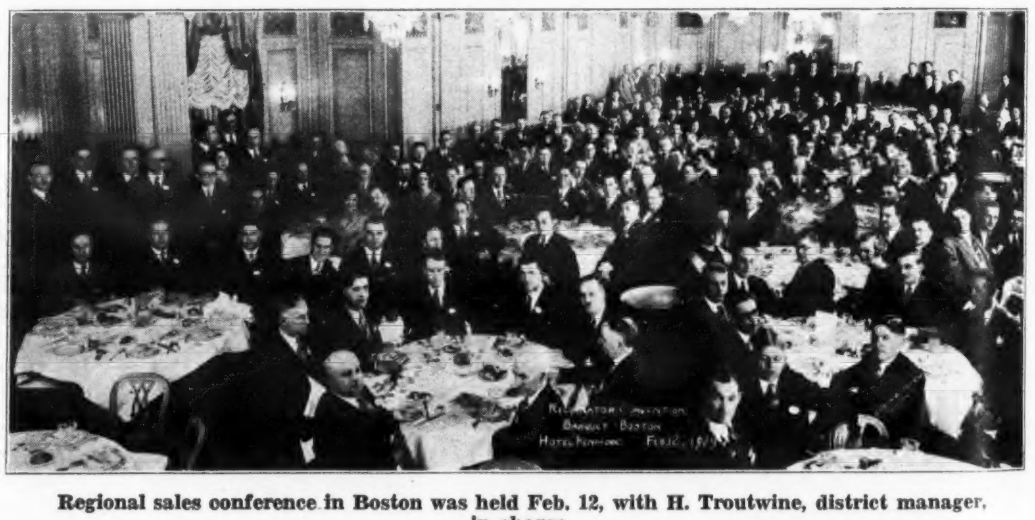


The Baltimore Kelvinator sales conference was held Feb. 15, Campbell Wood, district manager, in charge.



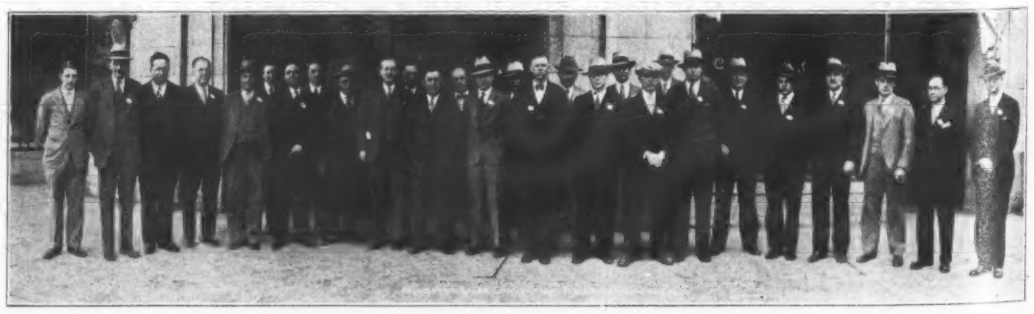
New York regional sales convention was held Feb. 11, under the supervision of N. S. Gotshall.

The regional sales meeting in St. Louis, Feb. 11, was in charge of L. W. Shadburne.



Regional sales conference in Boston was held Feb. 12, with H. Troutwine, district manager, in charge.

F. P. Hallock was in charge of the meeting at Jacksonville, Fla., Feb. 15.



The Denver regional sales meeting was held Feb. 27, W. B. Milliken, district manager, in charge.

KELVINATOR N. Y. BRANCH BANQUETS EMPLOYEES AT HOTEL ROOSEVELT MAR. 14

Employees of the New York Kelvinator branch were the guests of Nelson S. Gotshall vice president and general manager of the New York branch of the Kelvinator Sales Corp., Long Island City, N. Y., at a progress dinner held at the Hotel Roosevelt on March 14. Henry W. Burritt, vice president in charge of sales of Kelvinator Corp., Detroit, was the guest of honor.

John D. Cassidy, assistant branch manager, presided as toastmaster and delivered the keynote address. Other speakers on the program were L. A. Ryden, Roger Lynch, Frank H. Hughes, George A. Buckley, Nelson S. Gotshall and Henry W. Burritt.

More than 100 retail salesmen operating under the five sub-branch stores and members of wholesale domestic retail, domestic commercial, apartment house and service departments and general office attended this get-together meeting.

KELVINATOR DEALERS IN ARKANSAS ATTEND LITTLE ROCK MEETING

Kelvinator dealers in the state of Arkansas attended a one-day convention held in Little Rock on March 7. George B. Gray, manager of the Southern Radio and Equipment Co., Little Rock, Arkansas distributors of Kelvinator, presided as chairman at the meeting. The convention was brought to a close in the evening with a banquet at the Women's City Club and W. A. McDonald, vice-president of the Bankers Trust Co. was the principal speaker.

The domestic service school conducted by H. H. McGehe, Kelvinator factory instructor at the Southern Radio and Equipment Co., was brought to a successful close on March 9. Those who attended the school during its week session were:

Otis Matheny, Robbins-Sanford Mercantile Co., Searcy; Alex Mosley, Bradley Lumber Co., Warren; Jack Rogers, Conway Electric Co., Conway; Paul Allen, Southern Radio Equipment Co., Little Rock; John Hooks, Prescott Hardware Co., Prescott; Charles Phillips, Southern Radio and Equipment Co., Little Rock; T. R. Watkins, Nathan Furniture Co., Marianna; J. H. Taylor, Southern Radio and Equipment Co., Little Rock; John M. Pittman, Prescott Hardware Co., Prescott; Ray Reid and William Duncan, Southern Radio and Equipment Co., Little Rock.

The Charlotte, N. C., sales conference was held Feb. 13.

Again in March

All Kelvinator Records Broken with Greatest Month's Shipments in 15 Years' History

Gathering momentum with each succeeding month of 1929, Kelvinator shipments in March once more established a new all-time record for volume of business—the greatest single month's shipments in Kelvinator's 15 year history.

In the month just ended Kelvinator shipments were double those of March, 1928.

They were more than double the shipments of February, 1929, which in turn showed an increase of 110% over January, 1929.

To all dealers in electric refrigeration, these figures have special significance.

They mean that with April, May and June just ahead—normally the largest months in electric refrigeration sales—Kelvinator is pointed straight towards its greatest achievements.

They mean that the New Silent Kelvinator, with its new features and superiorities, is convincing thousands upon thousands that the wisest choice in reliable electric refrigeration is Kelvinator.

Kelvinator's new models are not only the brilliant first product of a new administration, but also the first step in a new era of the electric refrigeration industry.

Backed by the prestige of the oldest and greatest name in electric refrigeration, the Kelvinator franchise today offers a selling opportunity without parallel. Complete information and sales plans are ready for you.

These Features Are Creating Record Kelvinator Sales

1. POSITIVE SILENCE — with the most scientifically accurate, most precisely built refrigerating mechanism ever produced.
2. FULLY AUTOMATIC—The New Kelvinator needs no regulation. Positive and fool-proof control of temperatures, automatically maintained for perfect refrigeration.
3. NEW RUBBER ICE TRAY—Kelvinator again pioneers and is first to offer as standard equipment, the new flexible rubber tray for freezing ice cubes. Ice is removed in a few seconds without melting, and without shrinkage.
4. THE COLD KEEPER—A time-tested and proven economy feature of the Kelvinator. Acts as a constant reservoir of cold.
5. STURDY, ARTISTIC CABINETS—Embracing the most complete assortment of household models under any single name on the market. Built by Kelvinator to Kelvinator's rigid specifications.

Kelvinator Corporation, Detroit

Kelvinator of Canada Limited, London, Ontario

ELECTRIC REFRIGERATION FOR WATER COOLING

Electric Water Cooler Market Will Rival That for Apartment Equipment Says Copeland Man

Declares Present Tables on Drinking Water Requirements are Inaccurate and at Best are Only Slightly Indicative

By A. Rosmarin,
Copeland Refrigeration Co. of New York, Inc.

DRINKING water cooling opens a most fertile market for the manufacturer of electric refrigeration. It offers an important outlet for equipment that, if properly regarded, should be as great as that of the household and storekeeper.

Perhaps I am inclined to over estimate this field, but after three years of active selling of electric refrigeration, during which about 50 per cent of my time has been spent on drinking water cooling, my belief is that I am not over stating the conditions. The methods used by the electric refrigeration manufacturers, in going for this drinking water business, have been, with little exception, very slipshod and indifferent. It has been only very recently that concentrated intelligent attempt has been made to sell water coolers.

Looking at the water cooler market, I make this prophecy—that within five years the total number of water coolers sold will closely approach the number of apartment house installations—provided a similar amount of intelligent effort is applied to the water cooler as with the household unit.

Five years ago the new apartment house builder filled his apartments by offering electric refrigeration. Last month one of the most prominent business property managers in New York came to me to investigate our cooler. He stated that a new office building, now under construction, that will be ready in early 1930, was seriously considering individual water coolers. Now it is apparent to anyone who will stop and consider, that in cities like New York, there are just so many business firms and that new office buildings must be filled by taking tenants from older buildings. What then, is more natural than to give them something they are not getting elsewhere? To offer them an inducement which cuts down their overhead office expenses.

Methods of Selling

The sale of drinking water equipment is primarily simple: Direct canvass, mail campaign, operating through the architect, engineer, and general contractor. Direct canvass, using plenty of shoe leather will show the best results.

A salesman combining the direct canvas method with working with the architect and engineer, provides himself with a constant and lucrative income. The rub in the picture lies in the fact that manufacturers, distributors and dealers have assumed that the household refrigerator salesman is competent to sell drinking water cooling equipment.

The competent salesman should:

(1) Be able to read a set of plans and visualize the layout.

(2) Know his own equipment thoroughly.

(3) Be prepared to make proper proposals as to the best method of handling a job, his reasons for doing so should be clear to the buyer.

(4) He should point out the advantages and disadvantages, in cost, operation, installation and satisfaction of the unit system, stub end system, and circulating system, whether open or closed, or gravity system.

(5) He should know and be able to compare, at all points, the advantages of the electrically refrigerated water cooler, as against the owned ice cooler and the rented ice cooler.

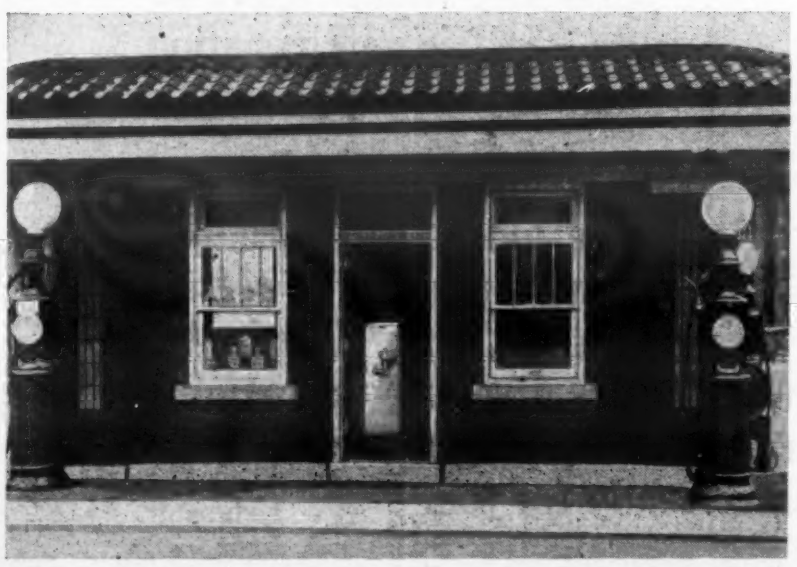
(6) He should know the advantages and disadvantages of the use of carbon black filters and other filters.

In other words—properly handled—water cooling is a specialized item, and the salesman should be a sales engineer. His prospect looks to him for guidance and a poorly conceived sale not only harms the company, but the others in the field as well.

Water Cooling Requirements

I shall probably call down the wrath of many so called specialists in drinking water by stating that the many learned and apparently authoritative tables, giving drinking water requirements are "all wet." The most one can say about them is that they are but slightly indicative. After having installed many coolers under all sorts of conditions, I have found these tables incorrect. Three of the engineers of one of the leading architects of this county, men who have had the burden of designing proper equipment for the largest public utility company in the United States, recently stated that these figures were all "hokum." It is up to the salesman to *personally* survey the job, weigh all factors, *and then* make his recommendations, using his knowledge of what his equipment can do, plus common sense, to determine his customers' requirements.

Electric Water Coolers Give Service Stations a New Appeal



Copeland water coolers are now being installed in stations of a nationally known oil company for the convenience of its patrons. Installations first were made in Pittsburgh, Pa., through the McKean Company, Copeland distributors for western Pennsylvania. Arrangements have been made through Edgar McKean, president of the McKean Company, for shipment of Copeland coolers to other points.

The cooler is placed in most of the stations directly opposite the front door where it is in plain view to the public and easily accessible.

FINDS WATER COOLER PROSPECTS IN MANY KINDS OF BUSINESS

DuBose & Pratt, Frigidaire distributors in Long Beach, Calif., are making a number of water cooler installations in that territory. "One of the interesting things about this type of installation," Glenn Pratt said, "is the different kinds of businesses and institutions that are suddenly waking up to their need of an electric water cooler. Almost every day we get an order from a new line."

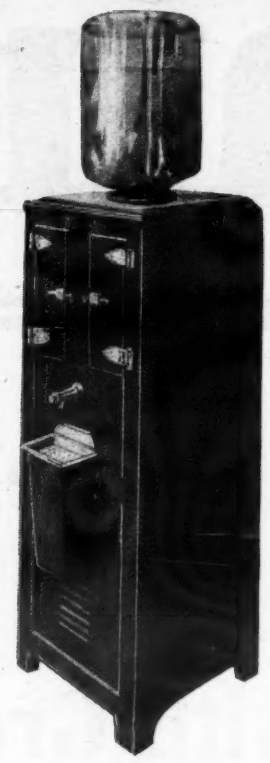
"The industrial roll offers a good prospect list for water coolers. Of course we have made many installations in apartment houses, hospitals and restaurants and other places where we have learned to expect such conveniences. Recently, we installed water coolers in the Schuh Restaurant and the Central Garage.

Frigidaire equipment for cooling 300 gallons of milk has been installed by this concern at the large dairy form of O. H. Goedhart at Hynes, Calif.

E. P. Lewis Co. Opens Frigidaire Display Room at Paducah, Ky.

E. P. Lewis Co., Frigidaire dealers for the western Kentucky district, have opened a new display room in Paducah, Ky.

We have read the March 13 issue of "Electric Refrigeration News" with a great amount of interest.—D. M. Frank, Williams Oil-O-Matic Heating Corp., Bloomington, Ill.



The Perpetual Cold Spring

Electric refrigeration, thermostatically controlled, forms an ideal means of producing, in the office, warehouse, or factory, a perpetual cold spring of wholesome drinking water maintained at an even temperature and is always ready for use. Refrigeration is automatically provided as required by the seasons of the year and the extent to which the water is used without human attention or regulation.

The Dyer electric water cooler is the pioneer of refrigerated water coolers in which the water is supplied from portable demijohns. This type of machine was first proposed in 1916 and since that time has been perfected into an attractive, portable refrigerating unit, useable wherever electric current is available.

The Dyer electric cooler is made in one general design and finish and in five distinct models for operation on either alternating or direct current. Including also models with separate cooling chambers and ice cube compartments.

All Dyer coolers are fully guaranteed against defective workmanship and materials for one year.

The Dyer electric cooler is the result of years of experience in this art. Equip with the Dyer cooler and be assured of

The Perpetual Cold Spring

Silent, Safe and Economical

DYER ELECTRIC COOLER CORP.
55 West 42nd Street, New York

37 ~~46~~ Wanted! partners

Only 37 Men Can Now Enjoy Our Offer to Make them Partners

WE published an advertisement in this magazine offering to 46 men an opportunity to become partners in our business. Of the hundreds that responded, nine have been chosen as the type of men that we want associated with us. They have been established in a lucrative business as Quiet May Dealers, and have entered into our profit-sharing plan as partners in our business. This same opportunity is now open to 37 more men—not misfits or failures—but wide awake business men who can and will be successful.

The Quiet May Dealers' Investment and Profit-Sharing Trust

For the first time in the history of the business a manufacturer is taking his dealers into partnership on a profit-sharing plan. No dealer is called upon to risk any of his money and those who participate in this Investment and Profit-Sharing Trust will automatically place themselves in line for a share of the *factory profits.*

Inquiries invited from interested people regardless of their present business affiliations.

MAY OIL BURNER CORPORATION

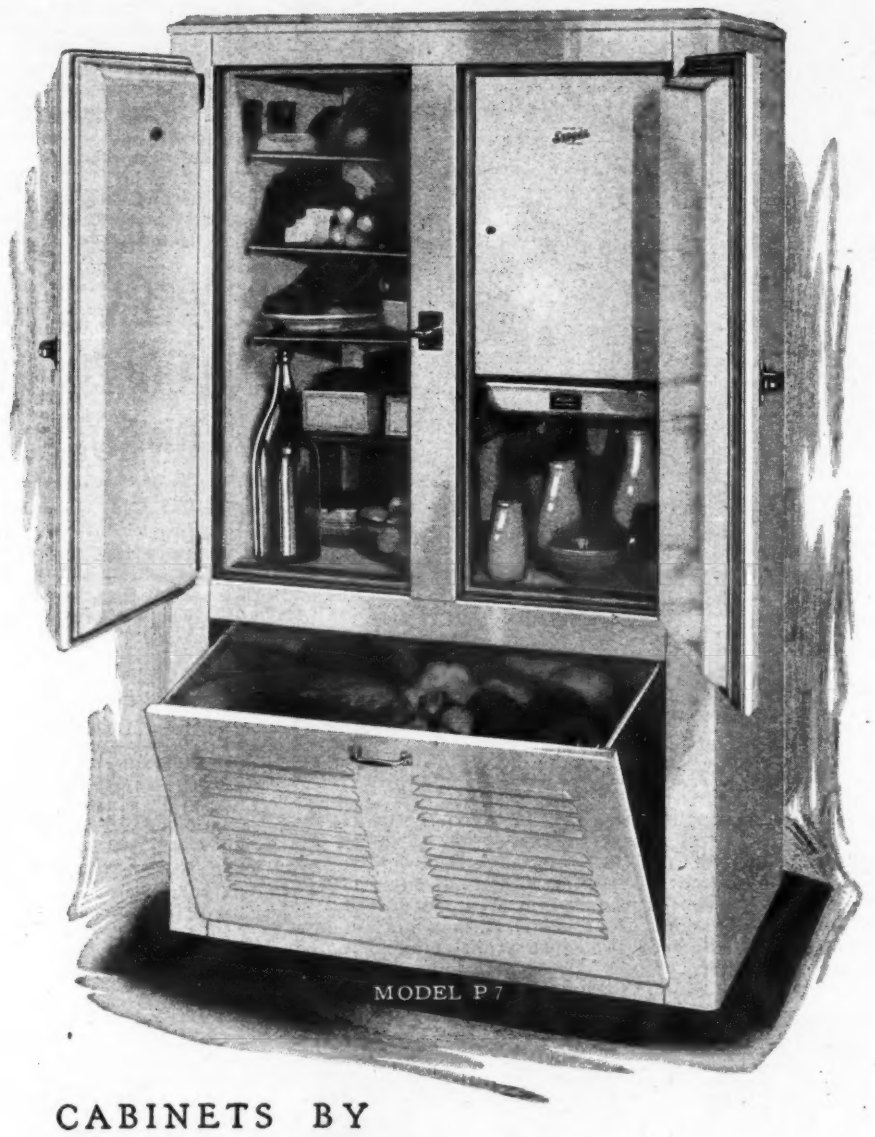
BALTIMORE, MARYLAND

OFFICES: NEW YORK 331 Madison Avenue; CHICAGO 35 East Wacker Drive; BOSTON 89 Federal Street

THIS PAGE ADVERTISEMENT APPEARED IN THE

SATURDAY EVENING POST

APRIL 6th, 1929



CABINETS BY

Seeger

SAINT PAUL

Distinctly modern and incomparably beautiful is the All Porcelain Senior Line of Cabinets by Seeger. Excelling in perfect preservation of food, compact convenience and lasting construction qualities, these Cabinets are presented in sizes to fill requirements from mansion to bungalow.

The Chromium plated hinges and locks are of a particularly modern design also, with a permanent finish that will endure polishing.

Each Cabinet is equipped with the Seeger Chiltray and may be had with the Seeger Vegetable Bin—both exclusive originations by Seeger.

The All Porcelain Senior Line of Cabinets by Seeger is built solely for use with Electric or Gas Refrigeration, being displayed and sold by your Local Refrigeration Dealer.

SEEGER REFRIGERATOR COMPANY

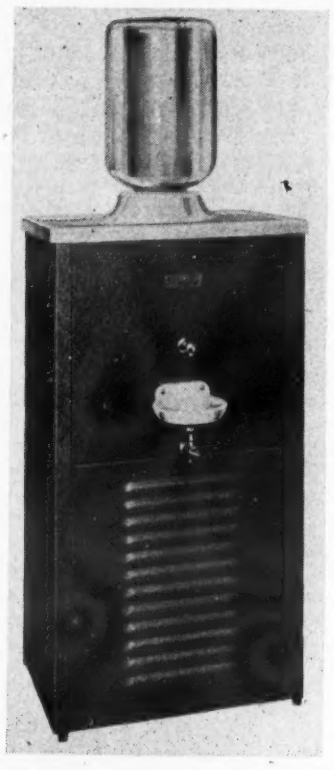
SAINT PAUL, MINNESOTA

NEW YORK	BOSTON	CHICAGO	ATLANTA	LOS ANGELES
389 Madison Ave.	26-28 Providence St.	228 N. LaSalle St.	392-4-6 Spring St., N W.	1340 E. Sixth St.

ELECTRICALLY REFRIGERATED WATER COOLERS

KELVINATOR ADDS 2 NEW COOLERS: BOTTLE AND PRESSURE TYPES

KELVINATOR Corp., Detroit, announces two new water coolers. Model WC1, bottle type, has a cabinet made of 18 gauge copper-bearing furniture steel mounted on welded angle iron frame. The lower front panel is removable and louvred to promote air circulation. The top is made of white vitreous porcelain one-piece cast iron with the bottle holder integral with the top. Dimensions on this model are: cabinet 23 in. wide, 16½ in. deep, 42¾ in. high,



Kelvinator Bottle Type Cooler

overall including receptor and bottle, 23 in. wide, 21½ in. deep and 60¾ in. high.

This model has a finish of sage green crystal, but other colors can also be furnished on special orders. Top, bottom and sides of water bath tank are insulated with corkboard and sealed with hydrolene. The water coil is constructed of ½" copper tubing tinned inside and outside. It has two sections connected in parallel to increase the rate of water flow. Model AJE No. 5520 compressor unit is installed in the base of this cabinet.

Model WC20, pressure type, has cabinet

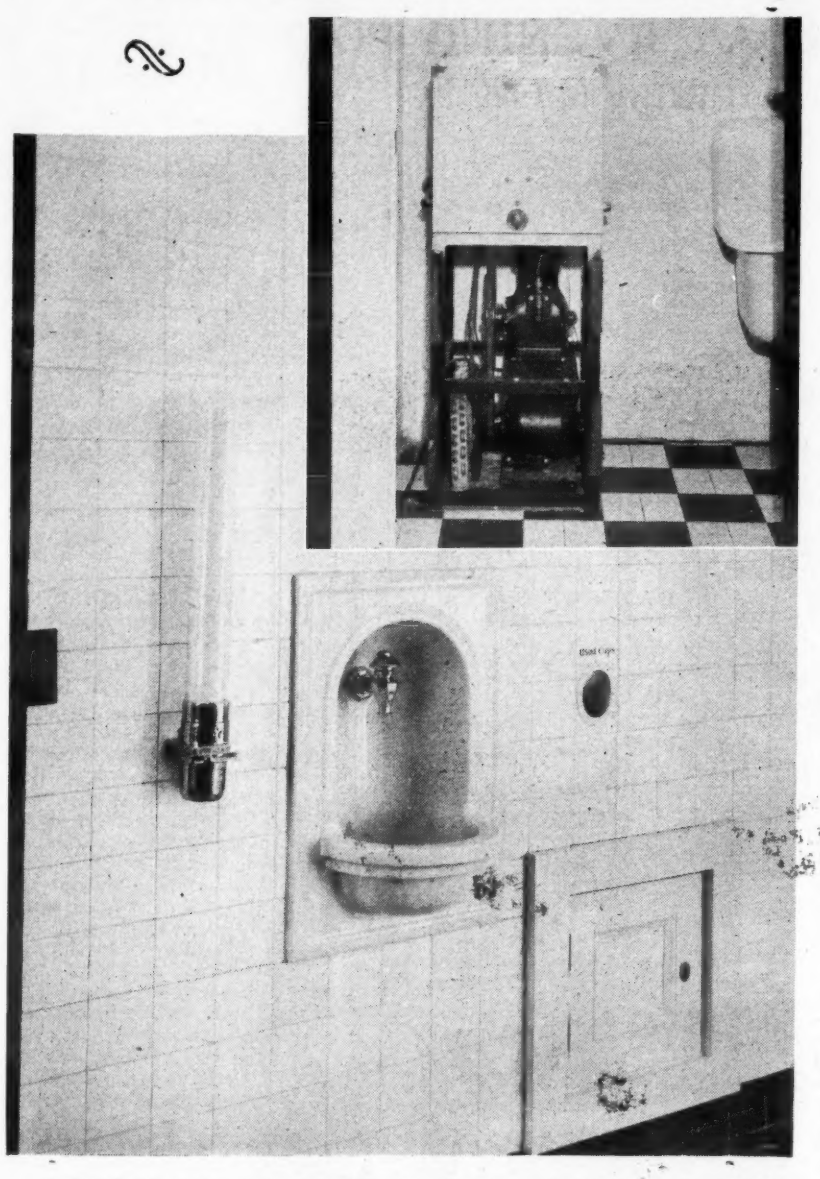
Kelvinator Pressure Type Cooler

construction similar to the model mentioned above, except that the bubbler bowl is integral with the top. Waste water connection is concealed within the cabinet. The water coil which is made of ½" copper tubing tinned inside and outside, is submerged in a sweet water bath cooled by a special copper tubing cooling unit. The temperature is regulated by an adjustable thermostat, bulb in the water bath. The dimensions of this unit are 23 in. wide, 16½ in. deep, and 39 in. high. Model AJE No. 5520 compressor unit is also used with this unit.

Geo. Belsey Co. Installs 12 Units in Art Colony Apartments

The Geo. Belsey Co., Los Angeles distributors of General Electric refrigerators, recently installed twelve refrigerators in a studio apartment building which is used exclusively by members of the Los Angeles art colony.

Copeland Supplies Cold Water to Patrons of Rochester, N. Y., Theatre



A Copeland water cooling system has just been installed in the Keith-Albee theater in Rochester, N. Y., by Thomas J. Northway, Inc. A model MC is used, connected with an attractively designed fountain outside. This has a cooling capacity of 14 gallons an hour. A two cylinder condensing unit is operated by a 1/3 hp. motor. The mechanical equipment is entirely out of sight, being placed in an adjoining room. At the left of the fountain is a supply of sanitary drinking cups, while at the right is a receptacle in the wall for used cups.

G. E. ADDS A COMPACT BOTTLE TYPE WATER COOLER TO ITS LINE

THE electric refrigeration department of the General Electric Co., Cleveland, Ohio, announces a new all-steel five gallon bottled water cooler. A white porcelain one-piece evaporator forms the water cooling compartment.

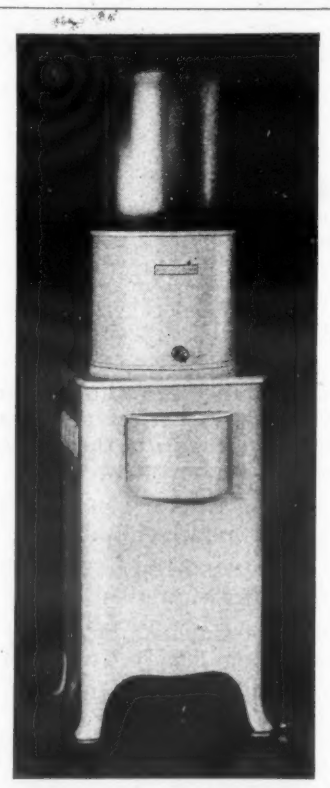
This unit which is 16 in. square and 44 in. high is equipped with a 1/10 hp. motor. Instantaneous cooling allows the unit to be shut off during the night or over the week-end. The cooler has a capacity of two gallons per hour cooled from 80°F. to 50°F. in a room with a temperature of 80°F.

The compressor and motor are mounted on three helical springs inside the housing and the complete unit is suspended in the casing by a steel cable. The compressor unit is of the single oscillating cylnder type direct connected to the motor and is enclosed in a hermetically sealed casing.

All moving parts are liberally lubricated by a single forced feed oiling system from a permanent oil supply, eliminating the necessity of ever re-oiling.

The condenser is air-cooled and is made highly efficient by attaching the condenser tubing to the sheet steel casing of the cabinet, thereby utilizing the entire outer surface for the radiation of heat. Free air circulation from the back and bottom further increases this efficiency.

Two other models are included in the General Electric water cooler line. Models C-2 and C-3 are of the angle stream type and are designed for city water connection. The cabinets for both models are the same. The dimensions for model C-2 are height, overall cooler and unit on 11" legs, 55½ in., width overall 28 in., depth cabinet 21⅝ in., depth cabinet over bubbler 29½ in. Model C-3 has similar dimensions except for height which is 55¾ in. The cabinets of both models are finished in white lacquer with a gray stripe. Model C-2 is equipped with a ⅛ hp. motor and has a capacity of two gallons of water per hour, while model C-3 with a 1/6 hp. motor has a capacity of 3.5 gallons of water per hour.



New G. E. Bottle Type Cooler

FILTRINE MFG. CO. MAKE FILTERS FOR USE WITH OWN OR OTHER COOLERS

The Filtrine Manufacturing Co., Brooklyn, N. Y., makes a complete line of water coolers (self contained and remote type) for use with dry system refrigerating machines of 100 to 2000 lbs. ice melting capacity.

In addition to coolers for industrial, restaurant, circulating systems and theatres, the Filtrine Co., manufactures and specializes in filters ranging in capacity from one-half gallon to 100 gallons per minute. These filters are small in size and weight and can be used with all makes of individual coolers and Circulating water systems.

HALSEY TAYLOR LINE HAS SELF-CONTAINED AND REMOTE MODELS

THE line of electric water coolers offered by the Halsey W. Taylor Co., Warren, Ohio, contains models for remote and self-contained installations. All cabinets are constructed of heavy gauge copper bearing furniture steel, electrically welded. The entire front and back panels are removable for installing and servicing compressor. Panels on the top and end are also removable for installing the cooling unit. All cabinets are finished in olive green.

The horseshoe type of coil used in all coolers is constructed of ½-in. seamless copper tubing, tinned both inside and out. The tank which is constructed of sheet copper, is insulated with 2-in. corkboard applied in hydrolene. Vitreous china receptors equipped with 2 stream projector and automatic stream control are set in a cast iron cover. The base of the receptor supply and waste fittings, self-closing stop and regulator are embedded in cork to prevent condensation on the outside of the cabinet.

COPELAND OFFERS 3 COOLERS FOR CITY OR BOTTLED WATER

COPELAND Products, Inc., Detroit, presents in the water cooler field three models; these are the model P for bottled water supply only, and intended for office and factory use, using cups or glass, and the models L and M of larger capacity and adapted either for bottled or city water lines.

The model P has a reserve capacity exceeding four gallons and a cooling capacity of 100 average drinks an hour. Its cabinet is of white lacquered steel, 16½x16½x46 inches, over a framework of wood and steel. It also may be obtained in colors. Two inches of corkboard is used for insulation. The overall height with the bottle is 64 inches and it is equipped to take the standard five-gallon bottle. The hardware is of chromium nickel. The drip basin is of white porcelain and a porcelain bucket, accessible through the door, accommodates the drainage.

This model is operated by a model S compressor, a special single cylinder type with a 1/6 hp. motor built especially for water cooler purposes. The model P can be placed anywhere and plugged into the nearest light socket. It is automatic in action.

The model P is meeting the demand for a small cooler for private and individual office use and many companies engaged in supplying bottled water are adopting it in place of the old fashioned iced cooler. It provides a constant supply of properly cooled water and eliminates the bother of icing. Also it is said to operate for less than the cost of ice.

The models L and M are identical except for the compressors. Model L has a single-cylinder condensing unit operated by a ¼ hp. motor and cools 8½ gallons an hour while model M uses a two-cylinder unit with a 1/3 hp. motor and cools 14 gallons an hour.

These models are 18½ inches square and, when used with city water supply, stand 47½ inches high. When equipped with bottled supply they stand 65½ inches high. They are finished in green pyroxylin lacquer over steel. White pyroxylin lacquer may be obtained at a slight extra cost.

Models L and M may be equipped with two outlets, the position of which are optional. One may be placed on either side, or one in front and the other on whichever side is more convenient. This feature makes the cooler adaptable to varying room and space conditions and has the advantage of permitting two persons to use it at the same time. These models when used with city water are equipped with a sanitary bubbler. For bottled water supply a spout is used for a drinking cup or glass.

ICEBERG COOLER HAS BEVERAGE CHAMBER AND ICE CUBE TRAYS

INCLUDED in the line of water coolers offered by the Iceberg Manufacturing Co., Gardner, Mass., are three city water type models and two bottle type models, all of which are refrigerated by model W compressor units which are installed in the base of each cooler. All models have cabinets of all-steel construction with finishes of duco brown, ungrained mahogany.

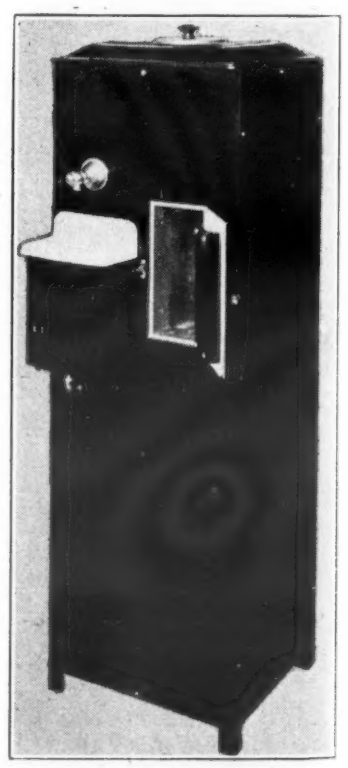
The model 100 A illustrated here is one of the most popular water coolers in the Iceberg line. In addition to its water cooling facilities it makes 24 ice cubes at one time and has compartments for cooling bottled beverages. Exterior dimensions of this unit are width 16 in., depth 16in., depth including waste water

Iceberg Bottle Type Cooler

pail 21 in., height 45½ in. This model has a cooling capacity of 2½ gallons per hour. The beverage cooling compartment will hold six bottles.

The other models in the Iceberg line have cooling capacities of 4 and 5 gallons per hour. Exterior dimensions are similar to the model 100 A illustrated above. Model No. 100 E has a fountain with an automatic stream control. The coils in the pressure type water coolers are made of seamless copper tubing, block tin plated. All the models are equipped with 1/6 hp. motors.

ERIE COOLER BUILT TO BUYER'S ORDER



A cooler, typical of those built to purchaser's specifications by the Erie Metal Furniture Co., Erie, Pa.

PORTABLE BOTTLE AND PRESSURE TYPE WATER COOLERS IN DYER LINE

THE Dyer Electric Cooler Corp., New York, N. Y., announces its line of electric water coolers containing portable models for use with bottled water and pressure filters and coolers for use with city water connections.

These models are approximately sixteen inches square and forty-five inches high, without the water bottle. Model No. 3 has compartments for making ice cubes and cooling bottled beverages. These models have capacities of 5 gallons of water per hour.

Now Lower Sales Costs Bigger Profits

on Servel flexible commercial line

Servel refrigerating units are so adaptable you can build up any installation from stock —special coils eliminated—new Servel Calculator simplifies engineering

IMAGINE a line of commercial refrigerating units so flexible that you can build up practically any installation from stock . . . with parts so light that *one man* can erect an ordinary job . . . with engineering so simplified that a salesman can complete all necessary calculations on his first call!

Yet this is exactly what the Servel commercial line offers. It cuts profit-eating erection costs and sales expense to the bone. It puts service out of the picture almost entirely. And, best of all, it gives the finest kind of performance—you can always be sure of satisfied customers.

Sturdy, quiet compressors

Take the Servel compressors, for instance. Every one of them—no matter what size—is sturdily built. Heavy castings give them a strength and stability that promises years of reliable service.

They are all slow-speed, too, which means greatly reduced frictional wear. They operate with a positive control of box temperature—no thermostats are necessary. And they are exceptionally quiet—especially in the large sizes—a big selling argument for cafeterias where the unit is right under the counter.

New flexible chilling section

But the great Servel innovation is the new all-copper chilling section. It is this that makes the Servel system so flexible . . . so easy to install . . . so profitable for you.

Look at it this way. These sections are self-defrosting. They are easy to handle (the largest weighs only 60 lbs.!). They come in a wide variety of sizes to fit all types of installations.

You can stock a full line of sections. You'll be able to build up any ordinary installation from stock. And you will have no left-overs—every size can be used on either new installations or extensions.

The preliminary engineering is a doubly simple job, too. In the first place, there's no figuring for specially built coils—where a mistake of a fraction of an inch makes the finished coil worthless.

Secondly, you have the new Servel CALCULATOR to help you determine what type of equipment is needed. This simple device does practically all the calculating on ordinary jobs. It enables a salesman to complete virtually all engineering while he is actually talking to the customer.

These CALCULATORS will be available to every Servel dealer's salesman.

On special jobs, you have all the facilities of the Servel commercial department at your instant disposal. Regional offices are prepared to handle any request for engineering help at any time. You can always count on receiving the assistance you need in the shortest possible time.

Worth careful thought

Already many dealers are cashing in on the Servel Commercial Line. These men have seen the tremendous possibilities in the commercial refrigeration field. They have gone after the business—and they're making real money.

You know the constantly increasing need for commercial refrigeration. You know the many lines of business that have found they can't get along without it.

A real opportunity

Here's a chance to get your share—and a big share, too, because Servel commercial refrigeration is easier to sell, costs less to erect, requires far less service.

Think this opportunity over. Check up on the commercial business to be gotten in your town. (You'll find it is far more than you ever imagined!) Then write us that you would like to have the full story.

SEAL of SANITATION
SERVEL
Electric Refrigeration
WE GUARD YOUR HEALTH BY PROTECTING YOUR FOOD

SERVEL SALES, Inc.

Commercial Division

Evansville, Indiana

Electric Milk Coolers--A Necessity on the Modern Dairy Farm

Extension of Power Lines to Rural Areas Opens New Field For Electric Refrigeration

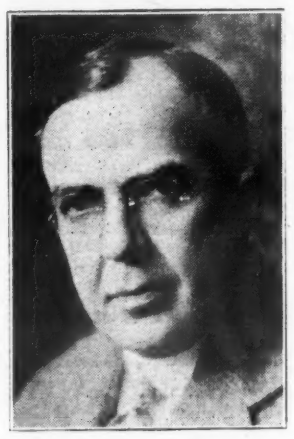
About 6,500,000 Farms in U. S. Now. Number Wired for Electricity Has Increased 150% in Last Six Years

By C. F. Stuart, Chairman,
Rural Electric Service Committee
National Electric Light Association

THE opportunity for development of electric refrigeration on farms must be obvious. It should be and, in fact, is proving more susceptible to development than the city. It is quite natural that this should be true.

The urban householder always has had ice readily available. It is obtainable at all times merely by putting a card in the window. It is common knowledge, however, that even in the city electric refrigeration has made rapid progress due to its convenience, economy and cleanliness.

There is a definite reason why electric refrigeration proves even more salable in the rural districts as soon as the power line is built. The farm family, excepting in rare instances, has no ice man passing the door ready to respond to a card in the window. In most instances farmers who use ice are obliged to do their own cutting, hauling, and storing, and in addition thereto find it necessary during the summer season to clean the cakes and put them in the ice-box daily. It is significant also that this method of providing refrigeration requires a capital investment on the part of the farmer which is not necessary for the city home. He must finance his own ice house. It may well be said that the farmer has more use for refrigeration than the city homes.



C. F. Stuart

The Farmer's Viewpoint

When the electric industry first undertook experimental investigations in the application of electricity to agriculture, care was taken to warn the farmers not to invest their money in impractical equipment or in equipment that might be designated as a luxury. A South Dakota farmer whose home was reached by a pioneer experimental line told me he was going to invest something like $300 in electric household refrigeration. I cautioned him against this, suggesting diplomatically that he should confine his investments to more practical applications. Here is what he had to say:

"I want refrigeration for my home. If I don't get electric refrigeration I have got to build an ice-house which will cost me about $300. Then I have got to drive ten miles each way in the winter time to cut and haul ice. I must buy sawdust and then in the summer time every day I must climb into that ice-house, chop off a cake of ice, wash it, and put it in the ice-box. Electric refrigeration calls for no bigger investment. When you figure that I can run this electric machine at a couple of dollars a month my time is certainly worth that, to say nothing of the convenience of the thing."

There was no answer to that argument and this farmer and many of his neighbors are enjoying electric refrigeration. One could go on indefinitely about the possibilities of residence refrigeration on the farm but one person's imagination on this subject is as good as another's.

The Commercial Market

There is another phase of this farm business to consider and that is the commercial refrigeration. It is the dairy farm which calls most loudly for commercial refrigeration. It provides proper and scientific cooling of milk; makes possible the delivery of milk with a lowered bacteria count. It is indispensable in handling bottled milk and in large plants provides ice in warm weather for wagon protection of milk.

All these services possess profit possibilities. In many cases dairies pay bonuses for extra sweet milk and cream and such bonuses often are sufficient to more than offset both the cost of electric energy and overhead charges on the electric refrigerating equipment. Bonuses also are paid for milk with minimum bacteria count.

These are just a few of the possibilities of electric refrigeration on the farm. There are nearly 6,500,000 farms in the United States. Electric light and power companies have been making rapid progress these last five or six years in extending their lines to serve these farmers. In fact, the number of farms connected has increased easily 150 per cent during the last six years and it is probable that the progress will be more rapid now that power companies are possessed of more definite knowledge regarding farm service.

As this extension of power lines into the farming districts continues, your own imagination can picture what a fertile field it is creating for electric refrigeration. It should invite the manufacturers of electric refrigeration equipment to devote their best efforts to designing the best possible type of refrigeration at the lowest possible cost. Many of the manufacturers have been working on this problem.

I repeat, it is a fertile field—this opportunity for selling electric refrigeration where ice is not readily available.

DISCUSSES RURAL LINE DEVELOPMENT IN MAINE OVER SIX YEAR PERIOD

The experience of the Central Maine Power Co., Augusta, Me., in its rural electric extension policy from 1921 to 1927 is outlined in an article entitled, "Rural Line Economics in Maine," which appears in the current issue of *Electrical World*. G. S. Williams, vice-president and general manager, and W. F. Wyman, distribution engineer, of the Central Maine Power Co., discuss the basic policies of their company in regard to financing, construction, agreement of customer to pay for certain amount of electricity per month, and other problems of rural line extension. At the close of 1927 about 4,322 farms were receiving electric service in Maine.

To show the farmer what can be done electrically in his work the company has three demonstration farms in poultry, retail milk and dairy fields. The College of Agriculture of the University of Maine is also doing extensive work in this field.

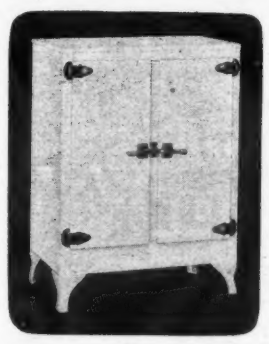
Brunswick-Kroeschell Milk Cooling Unit Shown at New Jersey Fair

"Cool milk instantly to 40 degrees" and "Sanitary cooling means bigger profits" read posters accompanying this exhibit of the Brunswick-Kroeschell milk cooling plant at Trenton, N. J.

SUPERIOR
REFRIGERATOR
CASTINGS

FLINT FOUNDRY COMPANY
Division of
General Foundry & Machine Company
FLINT, MICH. MARSHALL, MICH.

Porcelain **CABINETS** Steel



May we send you more interesting facts about these cabinets?

A Model to meet the need of every type of ELECTRIC REFRIGERATION from the
WORLD'S LARGEST PLANT
Devoted exclusively to the manufacture of cabinets for mechanical refrigeration

Belding-Hall's 45 years of quality leadership in building refrigeration is reflected in the design, construction and finish of these electric cabinets for self-contained, remote or multiple hook-up installations.

Belding-Hall Company
Factories and General Offices, Belding, Mich.

Something New!
to bring you BIGGER PROFITS
....and a NEW MARKET
for electric Refrigeration UNITS

The demand for electric milk cooling on the dairy farm is coming with a rush. Dairymen are finding it impossible to meet the higher requirements of today by ordinary means. They **must cool milk quickly to below 50°** and the ESCO Milk Cooling Cabinet is the only answer.

Constructed for use with practically any condensing unit on the market and in sizes to accommodate four to fourteen cans.

Sold only through Electric Refrigeration Distributors and Dealers and shipped complete with special Esco cooling coil, ready for attaching compressor.

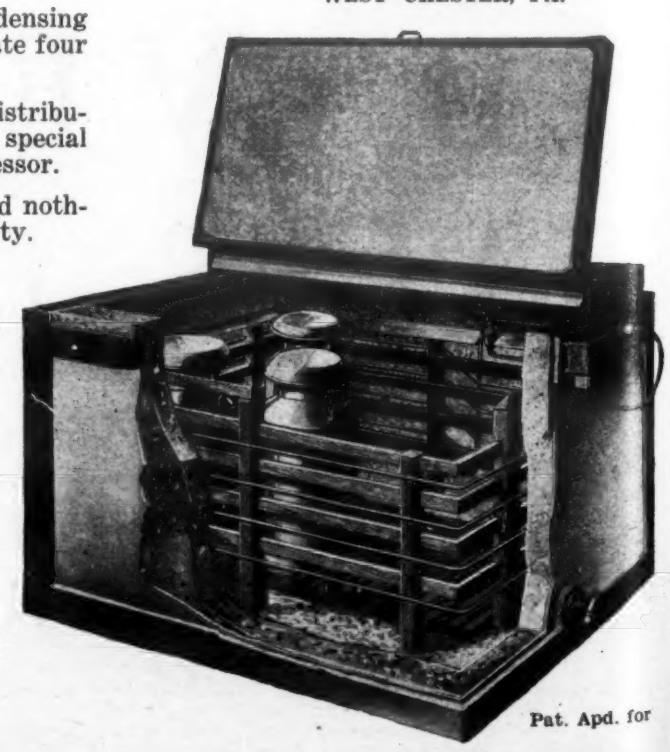
A highly specialized product and you will find nothing else like it. A truly wonderful opportunity.

ESCO
ELECTRIC MILK COOLING CABINET

Trade Mark Reg.

Filled With Ice
cold water, this thoroughly insulated cabinet provides the quickest and most efficient milk cooling known.

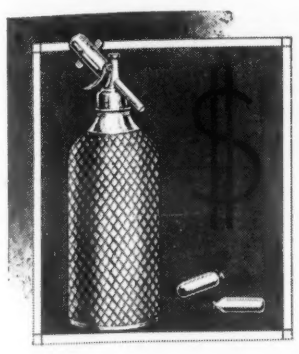
Write or Wire
today for full details
ESCO CABINET CO.,
Manufacturers
WEST CHESTER, PA.



Pat. Apd. for

SPARKLETS NOW BRING YOU MORE N-E-W PROFITS.

every apartment dweller using your refrigerator will become a steady customer



if ***you will follow this plan.*** Whenever an installation is made in an apartment house, make sure that a Sparklet Recipe Booklet, with your imprint, is placed in the freezing tray! Containing valuable recipes for using the refrigerator, never fear that this booklet will be thrown away! On the contrary, it will establish immediate contact with new tenants, and make them steady customers for profitable sales of Sparklet Bulbs and Syrups.

Analysis Discloses Your Need of Sparklets for After-Sale Profits

When you sell a refrigerator, the incident is closed. Your profit is made. Your only contact with the user is for service. The very long life of the product you sell prevents early repeat business.

Your customers are all customers-for-a-day.

But Sparklets, by solving the vexatious problem of making ice cream, thereby creates a steady demand for Sparklet Bulbs and Syrups on which you make a substantial profit. Your "customers-for-a-day" thus become "customers-for-always."

Sparklets Make Service Men's Calls Show Direct Profits

Instruct service men to carry Sparklet Syphons and Recipe Books with them when making calls. *In this way you can eliminate all service expense from your business!* In a recent instance, a service man in Chicago, making calls in apartment houses, sold thirty-one Sparklet Syphons in a single morning! In another case, the Sparklet profits have been paying the store rent for a prominent refrigerator distributor!

Make *all* your customers, customers-for-always, by using Sparklets' novel proposition. An inquiry to any of the addresses listed below will bring you profit assistance.

SPARKLETS

INCORPORATED

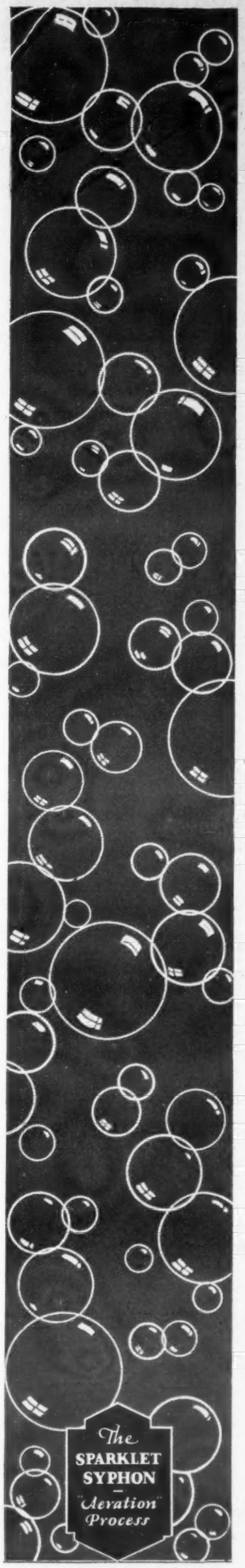
NEW YORK, 19 West 44th Street, *Headquarters* CHICAGO, 900 Rush Street

ST. LOUIS, Victoria Building ATLANTA, 411 Norris Bldg. DALLAS, Allen Building SAN FRANCISCO, 277-285 Seventh Street.

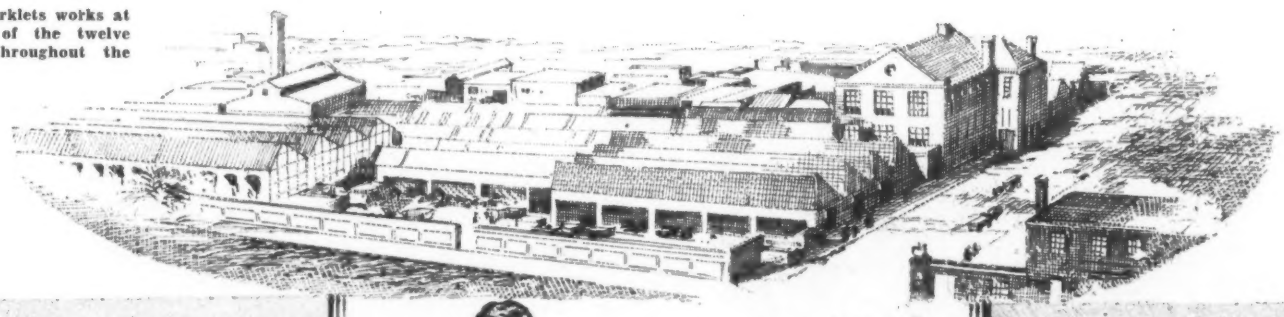
Purveyors of the Sparklet Syphon, Sparklet Bulbs and Sparklet Syrups, discoverers of the Sparklet "Aeration" method of making real ice cream in the freezing tray, which has been endorsed and approved by the following:

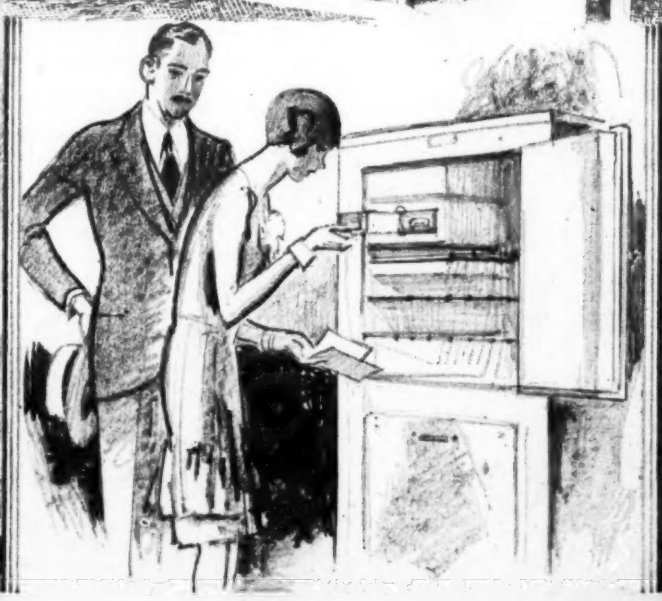
Manufacturers: General Electric, Servel, Kelvinator, Zerozone, Copeland, Absopure, Welsbach, Electro-Kold, Holmes, Universal, Norge.

Bureaus: Good Housekeeping Institute, Priscilla Proving Plant, Delineator Home Institute, Household Searchlight, New York Tribune Institute, Shrine Service.



This is a view of the Sparklets works at Edmonton, England, one of the twelve Sparklet plants located throughout the world.





COMPARES COST OF ICE AND ELECTRIC COOLING IN DAIRY

Check of Three Farms Shows Savings of Modern Methods

THE extensive work in electric dairy cold storage carried on in New Hampshire during the past few years is outlined in two bulletins published by the New Hampshire Agricultural experiment station at Durham. W. T. Ackerman, project director and field engineer of the agricultural station, author of the bulletin gives data concerning electrically refrigerated milk coolers on three farms.

Bulletin No. 233 entitled, "Electric Dairy Cold Storage" is devoted to an extensive discussion of milk cooling. The location of the storage room on each farm, the costs, equipment, current consumption and method of handling milk are discussed. The operation of the various units on the three farms are compared. Tables give the variations in temperature, time operation and costs of refrigeration. A section of this bulletin is devoted to the cost of refrigeration using natural ice. A comparison of natural ice and electric refrigeration revealed that the saving by the electric method varied from $93.05 to $185.78 on operating costs on the three farms.

Bulletin No. 233 contains the following summary:

The practicability of electric dairy cold storage has been tested for two to four years on three retail dairy farms in the New Hampshire rural electrification experiment. The storage rooms vary in size from 170 to 206.7 cu. ft. contents and have been operated under a variety of conditions with similar equipment of the dry room type.

Initial investments for mechanical refrigeration equipment were from $635 to $766, whereas initial investments for the ice method on the same farms varied from $135 to $775 with an average of $455. Yearly fixed charges were thus generally less for the ice method. Cash or money-out-of-pocket expense for operating refrigeration was in general less for ice, but in one case was in favor of the electric method.

Current consumption or operating costs of the electric method ranged from $37.31 per year to $75.60 on rates varying from 3 1-7 cents to 7 cents per kwhr. The average was $54.80 per year. Operating costs (labor, ice and sawdust) for natural ice refrigeration ranged from $170.10 to $320.80 with an average of $238.09. Due to the almost entire elimination of labor, the operating costs for the electric method were consistently less than for ice. Operating costs with ice were approximately 150% to 440% greater, or an average of 320%.

Total operating costs for the year, including labor, interest and depreciation, average $118.33 for the electric method, and $236.56 for the ice. The annual current consumption varied from 772 to 1,479 kwhs. during nine to twelve months. The bulk of the load was in July, August and September.

The storage rooms were designed to carry an average load of 300 quarts of bottled milk a day. Up to 420 quarts have been stored satisfactorily and under extreme temperature conditions. The maximum outdoor temperatures contended with were 102° to 104° in the sun at which time the cold storage was 50° on one farm and 44° on another.

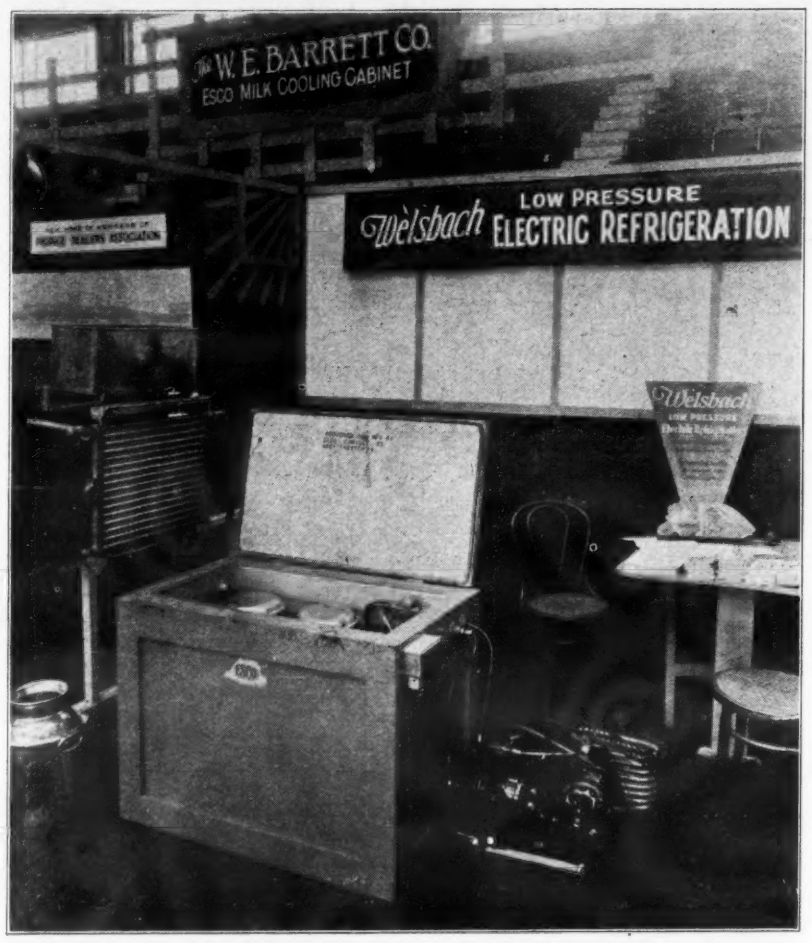
The equipment operated about 50% of the total elapsed time on two farms and 40% of the time on the third. Dairy cold storage consumed from 10% to 42% of the total amount of electricity used by each farm for a year. This percent varies according to the make-up of the remainder of the farm load.

The average total cost per cu. ft. of total contents was $1.18 for the ice method and $.62 for the electric. The cost per 100 qts. of milk for a year was $.30 for the ice method and $.15 for the electric. The equipment is pronounced desirable, practical and economical by all farmers using it.

It is foreseen that some farmers, by reason of good local conditions and requirements of keeping labor steadily at work, will find the use of ice cheaper. The more business a farm has, however, the more valuable will be the electrical equipment.

In the extension circular No. 85 the construction of a dairy cooler is thoroughly covered. The types of equipment, location, size, insulation of the coolers on the three experimental farms are described. Suggestions for wholesale storage and method of converting an old ice cooled storage for electric refrigeration are also included in this bulletin.

Esco Milk Cooler With Welsbach Unit Exhibited at Agricultural Show



The milk cooler shown in the above Esco-Welsbach exhibit at the Rhode Island State Agricultural show held at Providence recently, was manufactured by the Esco Cabinet Co., West Chester, Pa.

SMALL MILK COOLING UNIT ANNOUNCED BY BAKER ICE MACHINE

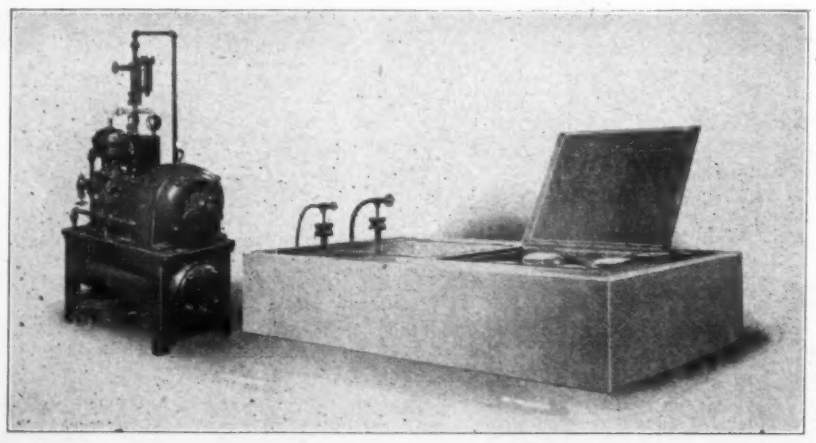
The Baker Ice Machine Co., Omaha, Nebr., has announced a small compact milk cooling unit for use on dairy farms and ranches, to be placed on the market soon.

It is 3ft. wide, 10 ft. long, and 3 ft. high. The sides are insulated with 4 inches granulated cork and the bottom with 4 inches of solid cork board.

The unit has 40 gallons storage capacity and makes 150 pounds of ice daily. There is a dry storage compartment with a capacity of 7½ cubic feet. A small milk cooler attachment cools the milk before it is stored.

The motor is 1 hp. The refrigerant is anhydrous ammonia and brine is used in the freezing tank and for circulation through the cooler. The condenser is water cooled or a cooling tower may be used.

Frick Direct-Drive Unit Refrigerates Small Dairy Plant



Frick Submerging Type Milk Cooler

The Frick direct-drive refrigerating unit in the above dairy farm plant is manufactured by the Frick Co., Waynesboro, Pa. The milk cans are cooled by placing them directly into cold water, in which ammonia coils connected to the refrigerating unit are submerged. Cork insulation is used and the tank may be had in various styles of either steel or concrete. This Frick unit can be driven by a direct connected gasoline engine on farms where no electric current is available.

IOWA FARM SURVEY INDICATES NEED OF ELECTRIC COOLING

THAT electric refrigeration is very much needed in the farm home, is the conclusion of a survey of the utilization of electric equipment and appliances in the farm home, made by Harriet C. Brigham,-Frank J. Zinck, and Frank D. Paine at the Iowa State College of Agriculture and Mechanic Arts.

At the time the survey was begun, at Garner, Iowa, the electric iron and washing machine were the only appliances in use but as the project progressed, other devices were added, among them electric refrigerators, and data on their operation collected.

The general reaction to the electric refrigerator was that the people who had them, "would not care to do without them." The survey was made with the hope that many of the Iowa farm homes would find it possible to eliminate much of the drudgery by the application of newer household appliances and use of electricity.

The survey reads, in part, "As is the case in many Iowa homes, the majority, before the installation of the refrigerator,, kept food in the milk house. This was usually some distance from the work center in the kitchen, necessitating many steps for food storage. The distance to the pump or milk houses ranged from 10 to 200 feet.

"In two of the homes, the supply of ice had formerly been hauled 10 miles from a lake. One box had a 150-pound capacity and was iced once a week."

Refrigerators kept in the kitchen had a much more uniform monthly consumption than the ones kept in pantries, back halls or in a room off the kitchen. Convenient location may have influenced this.

Where electric refrigerators were in use they varied in price from $210 to $535. Average monthly consumption was 52.41 kw.-hr. Sizes of boxes varied from 4.53 cu. ft. to 35.5 cu. ft. In only one home was the refrigerator used for the storage of cream. One woman preferred a larger refrigerator that could be used for farm produce, even to keeping a crate of eggs to eliminate taking the eggs to and from the cellar.

Only two were used to any extent for freezing desserts and these were where there were small children in the family.

Initial cost and operation cost were given as disadvantages but most of the women would buy in spite of these objections.

In summing up the part of the survey dealing with electric refrigeration, the report reads, "The electric refrigerators effected a saving of time and energy for the housewife. A decrease in food spoilage and an increased variety of menus has resulted. More fresh fruits, vegetables and fresh meats were used. Foods which had been purchased daily or once in two days were purchased weekly, thus eliminating numerous trips to market."

With only small amounts of money available the choice of equipment for the farm home was usually the small appliances. When larger sums were available the usual order of choice was, lights, washer, water pump, hand iron, range or range attachment, refrigerator, vacuum cleaner, ironing machine, and small equipment.

New Buffalo Apartment Equipped With Sixty G. E. Refrigerators

Sixty General Electric refrigerators were recently installed in the Sovereign Apartments in Buffalo, N. Y. The installation was made by Erco, Inc., local distributors for the Manufacturers' and Traders' Trust Co., owner of the apartment building.

"The one real trade journal in the refrigeration industry."—John Demaree, M. H. Moise Co., Louisville, Ky.

From every side

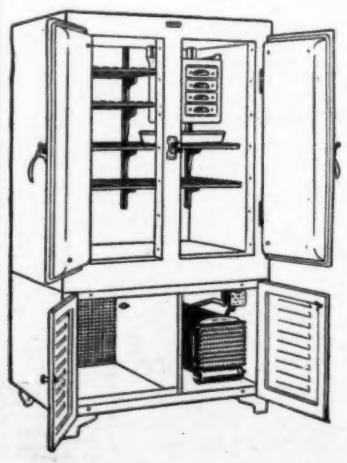
comes approval of this new

ELECTRIC REFRIGERATOR

THE success of the Holmes Electric Refrigerator was foreshadowed even before it was announced. Public interest had been sharpened to a razor edge. Each mail brought a flood of inquiries from all parts of the United States and even foreign countries.

Yet since its announcement, interest has been even keener. Consumer inquiries received mount into the hundreds. Every possible indication points to an overwhelming success such as seldom comes to any new product.

Retail merchants interested in an advanced electric refrigerator—simplified, refined and perfected in every detail, backed by a comprehensive, hard-hitting sales and advertising campaign, should write or wire at once. Holmes Products, Inc., 205 E. 42nd Street, New York City.



HOLMES

ELECTRIC-REFRIGERATOR

SEVEN MILK COOLING UNITS IN BRUNSWICK-KROESCHELL '29 LINE

THE Brunswick-Kroeschell Co., New Brunswick, N. J., offers a line of milk cooling units containing seven models with capacities ranging from 320 to 600 quarts daily. Three systems of cooling the milk are available. In the wet storage cabinet type are four models, two of which are equipped with aerators and circulating pumps. Cans containing the warm milk are placed into the cabinets which contain cool water that serves as the cooling medium.

The second type or two-compartment cabinet with dry storage is divided into two sections, one of which is a dry storage compartment, while the other contains cold brine used for circulating through the aerator. In the third type of unit a refrigerator is used in place of the cabinet. This contains a brine tank and dry storage space for milk cans or bottles.

Units Nos. M-1 and MA-1 have machines mounted with the cabinet, while the others have the compressors mounted on cast iron bases separate from the cabinet. Unit No. MAS-3 with a two-compartment cabinet has facilities for making 150 pounds of ice daily.

ESCO CABINETS HAVE CAPACITIES FROM 4 TO 14 CANS OF MILK

THE line of electric milk cabinets offered by the Esco Cabinet Co., West Chester, Pa., includes cabinets with capacities ranging from 4 to 14 cans of milk. These models, designed for installation with practically any small refrigerating unit, can be used either in connection with an aerator or without an aerator. Where no aerator is used the cans of milk are immersed in the water in the cabinet, the heat in the milk being absorbed by the cool water. When an aerator is used the milk is cooled to a temperature of 65 degrees by passing over the aerator. The cans are then placed in the water in the cabinet for further cooling.

The interior and exterior of Esco cabinets are made of 26 gauge rust resisting Toncan iron. All models are insulated with three inches of corkboard. The lid built of spruce is insulated with two inches of corkboard and covered with Toncan iron. The refrigerating coils which are made of ½ in. copper tubing circle the interior of the cabinet. These coils are supported and protected by a spruce rack. A bottom rack protects the base of the cabinet and permits the water to circulate under the cans. The temperature of the water is controlled by automatic thermostat. An overflow and drain pipe made of ¾ in. galvanized pipe is located at the end of the cabinet.

EBCO FEATURES THE ANGLE JET BUBBLER ON FOUNTAIN MODELS

The D. A. Ebinger Sanitary Manufacturing Co., Columbus, Ohio, offers a line of self-contained and remote electric water coolers. Included in the Ebco line are models of the bottled water type and those designed for connection to city water lines.

All cabinets are constructed of 18-gauge copper-bearing furniture steel, with all parts welded together. The interior container in all models is made of sheet copper with all joints seamed and soldered. The square or rectangular units in the Ebco line are insulated with corkboard 1½ to 3 in. in thickness applied in hydrolene. The water coils are constructed of tinned copper tubing, tinned inside and out. The cooling capacities range from 1½ to 85 gallons per hour. Fountain models are equipped with angle jet bubblers and self-closing automatic regulating valves, producing a constant single stream which does not vary in height.

G. E. ALL-STEEL SPRING SALES CONFERENCES ARE ATTENDED BY HUNDREDS

(Concluded from Page 4, Column 5)

tributors, and dealers attended the conference held by the Judson C. Burns Co., at the Benjamin Franklin Hotel, in Philadelphia, March 27.

Ochiltree Electric Co., Pittsburgh, Pa., J. E. Spence Co., Altoona, Pa., and W. N. Hogan, Inc., Wheeling, W. Va., held a joint meeting at Pittsburgh, March 28. Three hundred fifty dealers and salesmen attended the meeting.

Approximately 200 dealers from east, central, and south Texas attended the conference in San Antonio, March 25. The meeting was held through the cooperation of the Edmundson Refrigerating Co., Houston, the Findlater Hardware Co., San Angelo, and Wright Bros., San Antonio.

Meetings held earlier and reported in the March 27 issue were those at Billings, Mont.; Boston, Mass.; Seattle, Wash.; New York City, Omaha, Nebr.; Detroit, Mich., and Milwaukee, Wis.

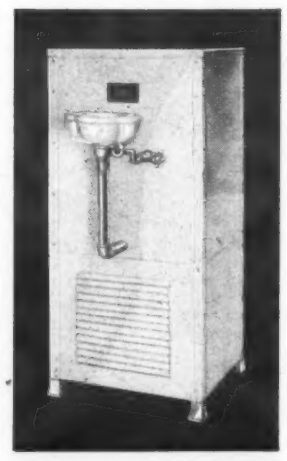
Approximately 500 General Electric refrigerator salesmen and dealers in California and Arizona were present at a sales meeting held at Barker Brothers auditorium in Los Angeles, Calif., on March 20. The George Belsey Co., Los Angeles, and George Bauder, San Diego, distributors of General Electric refrigerators were hosts to the visiting men.

George Bauder presided as chairman at the afternoon session at which the following were speakers: Walter J. Daily and F. M. Corliss, of the electric refrigeration department of the General Electric Co., G. Little and T. T. Ellsworth, of the Belsey Co. and W. H. Crawford, of the General Contract Purchase Corp.

General Electric refrigerator dealers operating in Georgia under the Alexander-Seewald Co., Atlanta, attended the spring sales meeting which was held in Atlanta on March 22. About two hundred dealers and salesmen attended the sessions which were held at the Atlanta Athletic Club. E. C. Dunbar, sales manager of the Alexander-Seewald Co., presided as chairman at the meeting.

W. D. Alexander, president of the Alexander-Seewald Co., in an address stated that Georgia, in proportion to her population, last year purchased a greater number of General Electric refrigerators than any other state in this country. Officials of the General Electric Co. who attended the meeting were A. A. Euhalt, G. C. Wasson, L. W. Driscoll, A. T. Taft, and J. J. Donovan.

FILTRINE SELF-CONTAINED PRESSURE TYPE COOLER

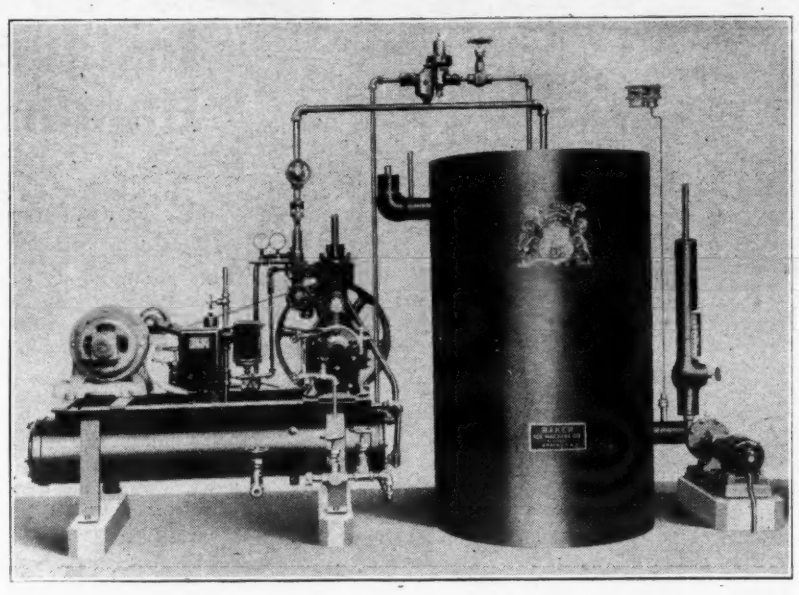


Model No. 1A With Filter Bubbler Made by Filtrine Manufacturing Co., Brooklyn, N. Y.

May Oil Burner Represented at New York Convention

The American Oil Burner Association opened a three-day convention yesterday at the Pennsylvania Hotel, New York. The May Oil Burner Corp. is among those having displays at the convention. Members of the May organization representing the company at the exhibit are: E. M. Fleischmann, A. J. Fleischmann, A. Klotzman, C. P. Culbert, Willard S. Karn, Reg. Ruxton, P. H. Jacobson, C. A. Benford, W. H. Deale, W. G. Shrive, Jr., Wm. G. Plunkett, E. P. Ryan, W. A. Webster, S. S. Strouse, and P. H. Hooven.

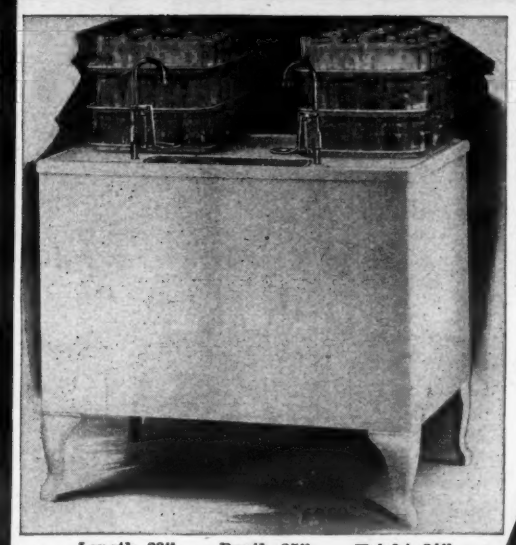
Standardized Water Cooling Plant Offered by Baker Ice Machine Co.



The Baker standardized water cooling plant has been designed for use in hotels, restaurants, apartments, hospitals and public buildings. Each plant consists of a self-contained refrigerating unit, water cooling tank, automatic control equipment and a pump to keep the cold water in circulation in the pipe lines. This plant can be used with either the pressure pipe, pressure tank or open tank type of water cooler.

Refrigeration Service Co. Inc.
SERVICE SPECIALISTS
Installations, Alterations, Repairs,
Inspection, Reconditioning, Maintenance
New York City Tel.: Medallion 0028
Nights, Sundays or Holidays
Susquehanna 4500
Office and Works 449 West 42nd St.
Warehouse 281 11th Ave.

The EBCO ELECTRICAL COOLER FOUNTAIN



Length 38" Depth 25" Height 34"

FOR CAFETERIAS

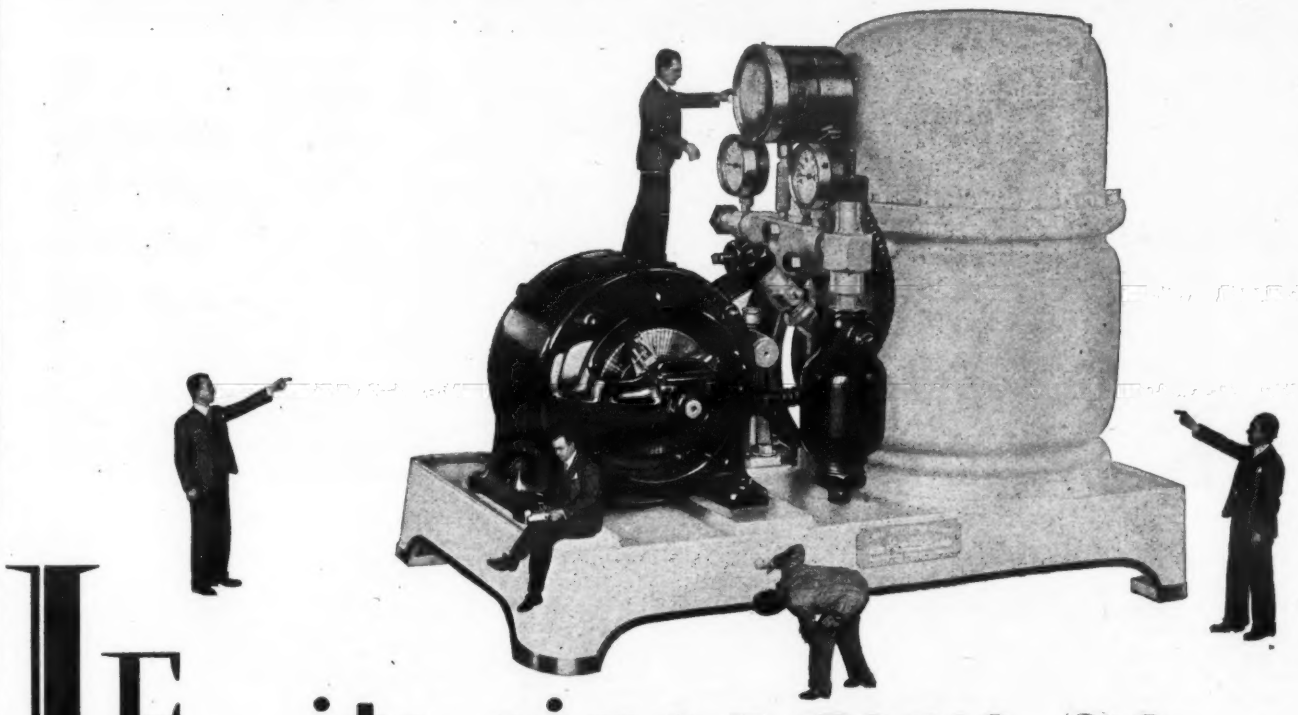
with large cold water storage compartment for the meal time rush.

Two No. 6 Glass Fillers — Recessed top and legs are porcelain enameled.

CAPACITY
1 hr. period
20 to 35 gal.
2 hr. period 50 gal.

WRITE for Catalog

The D. A. EBINGER SANITARY MFG. CO.
194 Lucas Street Columbus, Ohio
Manufacturers also of Ventilated Closets, Urinals, Slop Sinks and Soil Receivers for Toilet Rooms



IF... its size were as BIG as its value

You wouldn't have room enough for a Lipman if its size were as big as its value. But fortunately mere size is not a measure of value. A two carat diamond is worth a train load of sand.

The Lipman is almost invaluable to the user of commercial refrigeration. And it is the cheapest machine he can buy—not because of its first cost, but because of its ultimate cost. The true measure of value is always *the cost of ownership.*

The cost of ownership of a Lipman, meaning the cost of depreciation *plus* the cost of service *plus* the cost of operation, is extremely low. Judged on this accurate basis, the Lipman offers unmistakably the biggest value.

A comprehensive advertising campaign is telling the Lipman "story" to the trade from coast to coast. Investigate the Lipman franchise by sending the following coupon today. No obligation whatever.

Lipman ELECTRIC REFRIGERATION

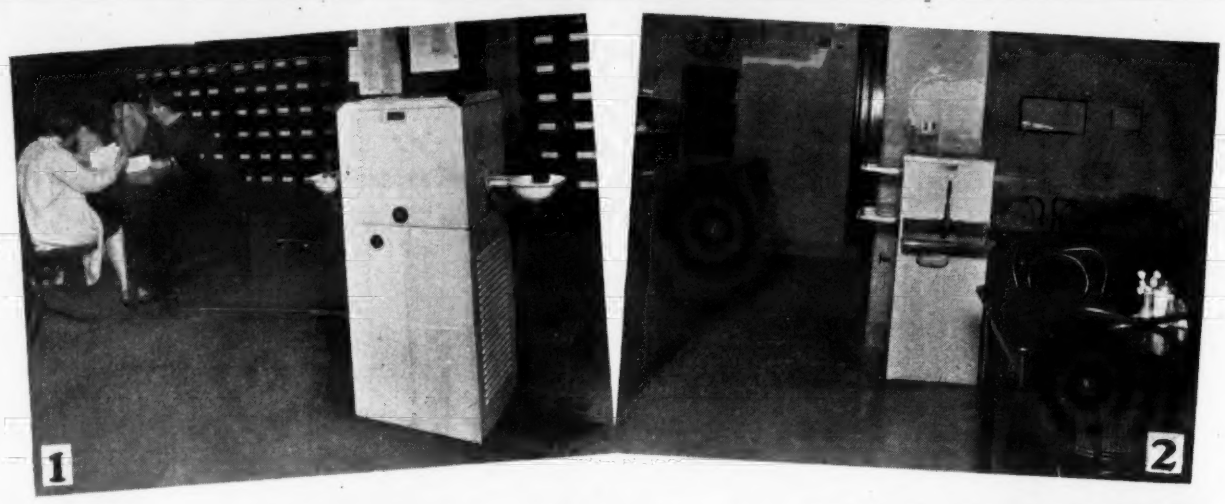
GENERAL REFRIGERATION COMPANY,
Beloit, Wis.

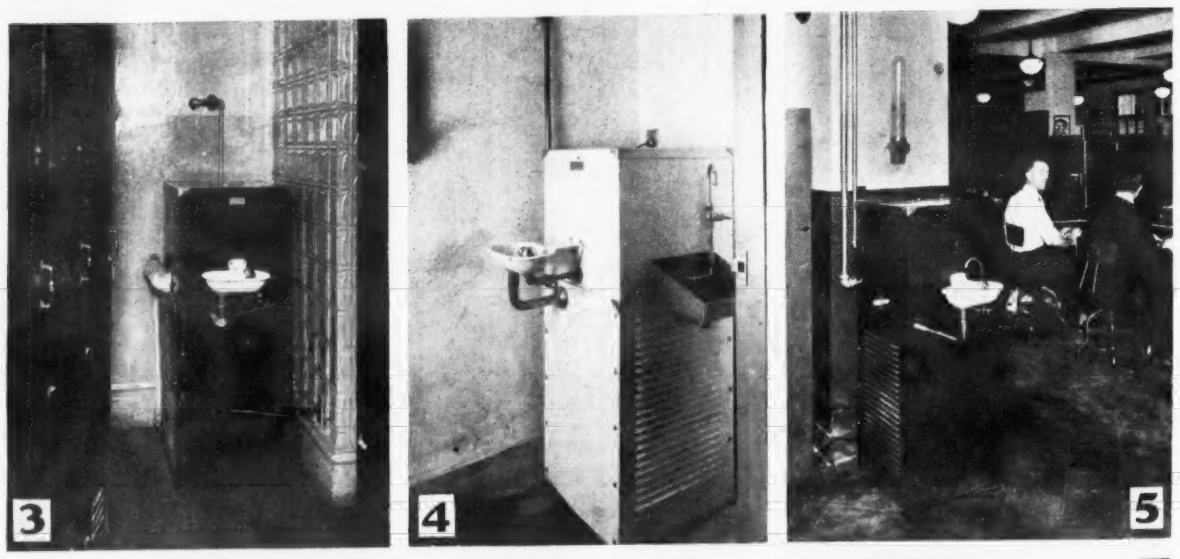
☐ Tell me about the Lipman Franchise. Send Booklet D-5

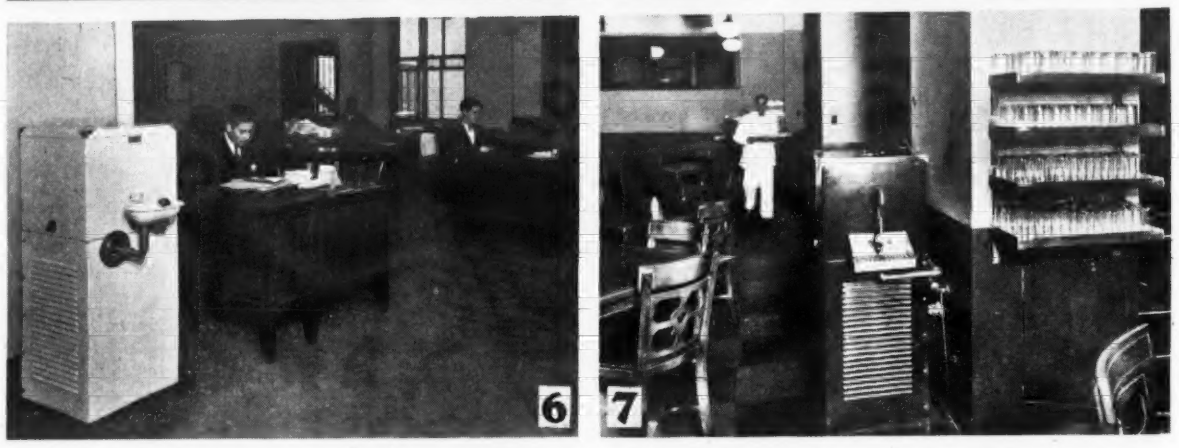
Name ..... Firm Name .....

Address ..... City and State .....

Typical Electric Water Cooler Installations by Copeland Refrigeration Co. of New York







Applications of Standard Copeland Water Coolers to a Variety of Requirements

THE photographs above show typical installations of water coolers made by the Copeland Refrigeration Co. of New York, Inc.

No. 1 shows the installation in the policy brief department of the New York Life Insurance Co. It is equipped with two standard fountain fixtures, bubbler and glass filler types. The cooler takes care of approximately 150 people.

No. 2 is an installation in the cafeteria of the Evergreen Exchange of the New York Telephone Co. It is equipped with an Allen pushdown glass filler, Monel metal drip pan and splash grid, four plate glass shelves, supported by nickeled brass brackets.

No. 3 shows an installation in the basement of the U. S. Postoffice, Lafayette Ave., Brooklyn.

No. 4 is an installation in the Yorkville Branch of the National City Bank, New York. The cooler has a standard fountain fixture, a combination glass filler and extra high gooseneck from which thermos carafes for the private offices can be filled.

No. 5 is the standard MC cooler, green finish, in the main cable receiving and sending room of the All-American Cable Co. It is in use twenty-four hours every day. A capped outlet on the side is for an additional fountain or remote connection.

No. 6 shows the installation of the white bubbler type cooler in the Union Indemnity Bldg., New York. The white piping is a cork covered refrigerated line leading to a fountain on the floor above and to one on the floor below. Three MC coolers furnish drinking water for the 500 employees in the building.

No. 7 is the installation in the cafeteria of the International Telephone and Telegraph Co. Bldg., which serves approximately 400 people each noon. The cooler is equipped with two glass fillers and a second cooler in the back of the room is similarly equipped. The building is thirty-three stories high and is equipped with twenty-four Copeland coolers. The cafeteria has Copeland refrigeration for storage, short order and salad service.

FRIGIDAIRE OFFICIAL SAYS NORTH PACIFIC 1929 SALES SHOULD REACH 7 MILLION

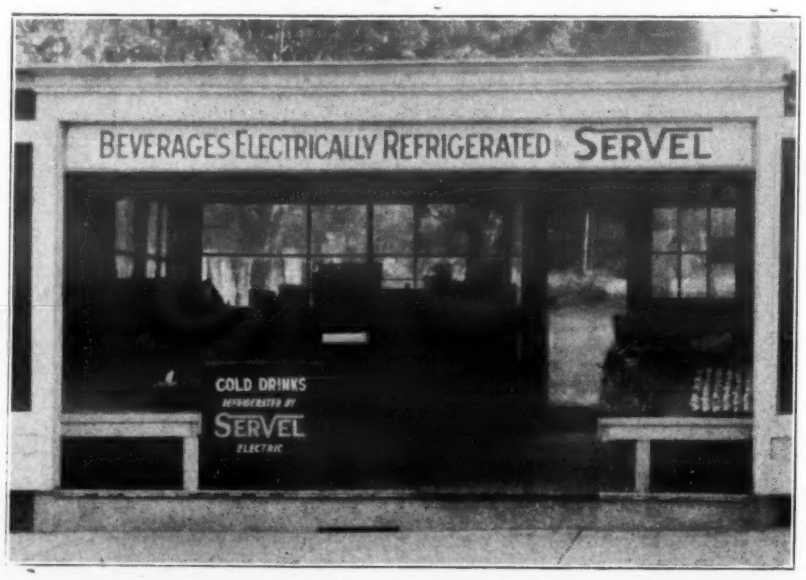
Seven million dollars worth of business was the estimate placed on 1929 activities in the western coast territory by R. F. Callaway, branch manager and vice-president of Frigidaire Corp., while on a tour through the west. He estimated that in two years the territory served by the Seattle branch would produce fourteen million dollars annual business for Frigidaire.

With Mr. Callaway on the trip were D. K. Baker, comptroller; E. D. Doty, advertising manager; J. E. Houser, chief inspector; L. S. Keilholtz, chief engineer; T. D. Fordham, works manager; H. F. Lehman, installation and service manager.

CALIFORNIA G. E. DISTRIBUTOR INSTALLS TWO MARINE JOBS

Davisson Co., Long Beach, Calif., distributors of General Electric refrigerators, has made several marine installations recently. The S. S. Yale plying between San Diego and San Francisco has been fitted out with a model PL17 in the pantry service. Three General Electric refrigerators were installed on the S. S. Honolulu plying between Los Angeles harbor and the Islands, two were models R52 and the other a RT7.

Capitalizing on His Equipment



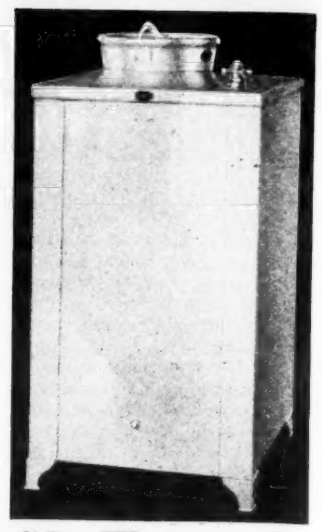
People passing by the White House Fruit Market, 910 Hamilton St., Allentown, Pa., are attracted by prominently placed signs advertising beverages cooled by Servel equipment. The manager says "I believe in advertising my equipment because customers like to patronize any store that is up-to-date."

Frigidaire Distributor Installs 15 Water Coolers in Factory

The Refrigeration Products Co., Evansville, Ind., Frigidaire distributors in southern Indiana and Illinois, western Kentucky and Tennessee, has completed the installation of 15 Frigidaire water coolers in the plant of the Mead Johnson Co., manufacturers of baby food ingredients.

MORE COOL WATER PER DOLLAR

Instantaneous— Handles Peak Loads



To handle peak loads is an imperative demand of industrial plants. Only Halsey Taylor DIRECT-FLO Electric Coolers, with storage tank and uniformity of temperature, can guarantee to meet this requirement! No matter what the load, these coolers can supply uniformly cool water, and at less cost than by any other method.

Trouble-proof, superior in every way, made in a variety of models and with exclusive selling features, DIRECT-FLO Coolers give you a real margin of profit and a genuine opportunity to clinch sales in a competitive field!

REAL PROFITS FOR YOU

There are many reasons why this new engineering achievement means real money to you, opening up a profitable new field of business to every wide-awake dealer! Write for details.

THE HALSEY W. TAYLOR CO., Warren, O.

Largest Manufacturers of Drinking Fountains Exclusively

Note—Although requiring a minimum of attention, the lack of proper service facilities in some sections as yet, makes it imperative that we confine the distribution of these coolers to Illinois, Indiana, Ohio, Michigan, Pennsylvania, New York, New Jersey, Massachusetts, Connecticut and Rhode Island.

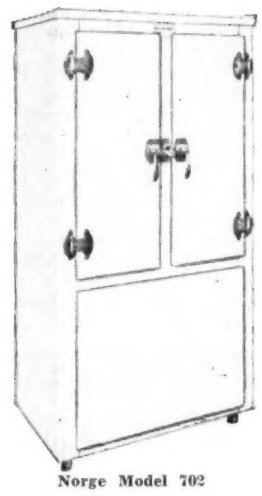
HALSEY TAYLOR *Electric* COOLERS

DIRECT-FLO—INSTANTANEOUS COOLING

A NORGE Franchise Yields Good Profits

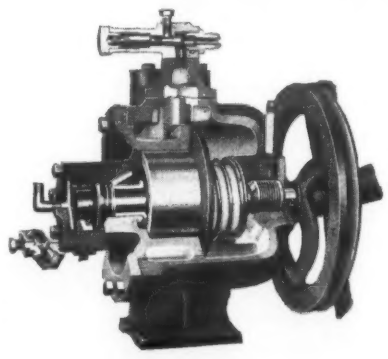
NORGE sales for the first three months of the season surpass any previous three months in the history of Norge.

With a complete, rounded-out line of finely constructed refrigerators, Norge distributors are meeting every type of demand for refrigeration. The illustration to the right shows the attractive design and sturdiness of the 7 cu. ft. De Luxe model. Norge distributors enjoy profits from sales to permanently satisfied customers.



Norge Model 702

The "Heart" of the Refrigerator is the Compressor



The "heart" of any refrigeration system is its Compressor. The Norge exclusively designed rotary compressor compensates for its own wear and is built to give years of trouble-free service.

Every Norge Refrigerator is equipped with this remarkably efficient and economical rotary compressor.

A letter or wire addressed to us will bring full information regarding the Norge franchise covering territory not yet assigned to a distributor.

Norge Corporation

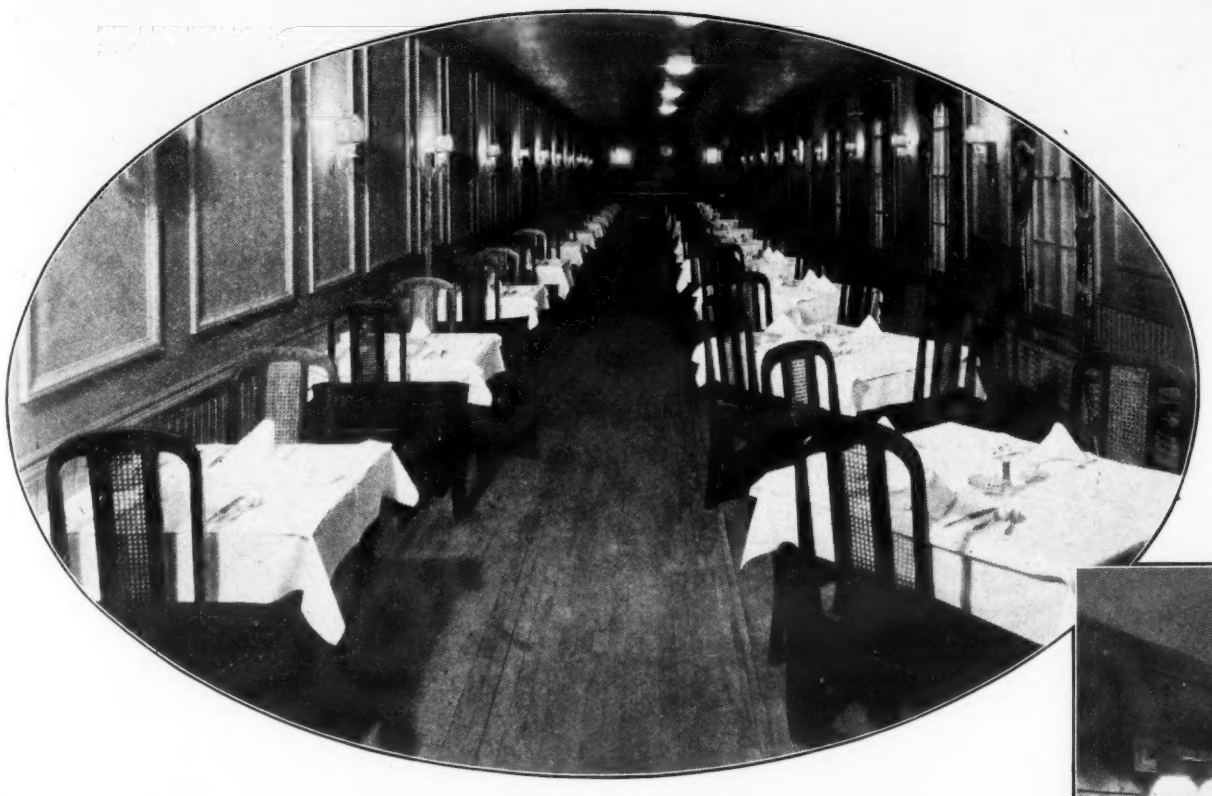
Silent, Economical Refrigeration

DETROIT MICH.

IN RESTAURANTS, HOTELS and Institutions

McCRAY EQUIPMENT

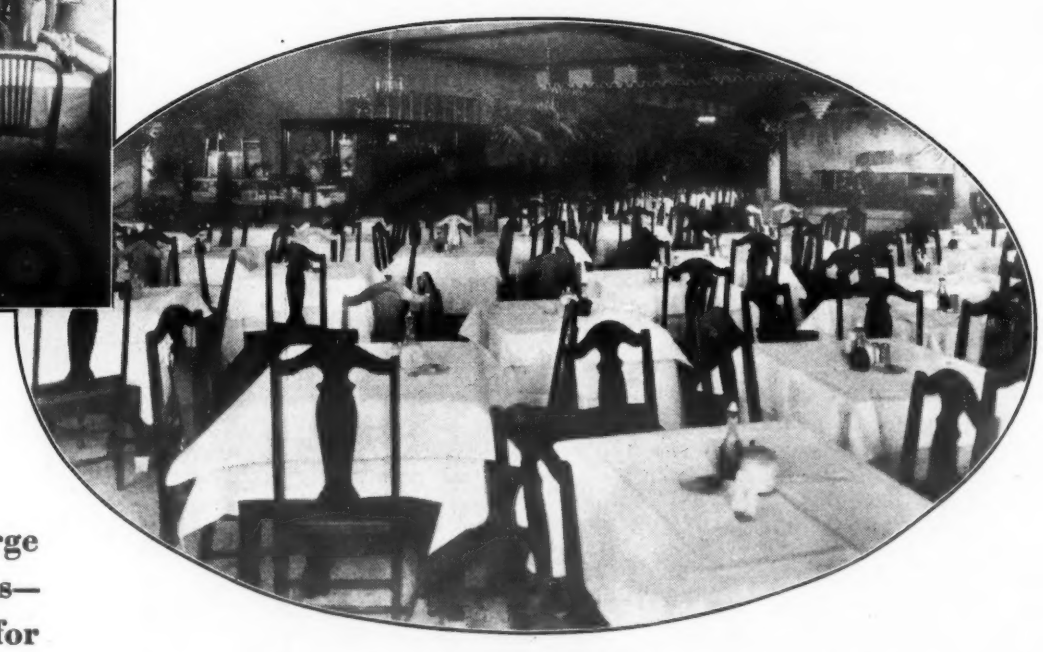
For Machines of Any Type



The Ogden Cafe, one of Milwaukee's finest restaurants. McCray refrigeration here enables utmost efficiency and helps maintain excellence of food at all times.

Beech Nut Dining Car, Indianapolis, Ind. A very attractive and novel eating place. Well known in the city for tasty food. McCray refrigerators used.

Pearl Garden Restaurant, Columbus, Ohio. A place much patronized by those who appreciate good food, splendid service and quiet dignity. McCray equipped.



Canton Tea Gardens, St. Louis, Mo. Again typical of restaurants in which McCray is furnishing thorough, economical refrigeration.

WHERE perishable foods must be handled in large quantities—as in hotels, restaurants and institutions—McCray refrigerators insure efficient service at low cost for operation, with machines of any type.

Pictured above are the dining rooms of a few of the thousands of restaurants throughout the country served by McCray refrigerators. The McCray nameplate has come to be recognized as the sterling mark on refrigerators.

Machine Refrigeration of Any Type May Be Used In All McCray Models. The quality built into every hidden detail of McCray construction insures efficient, economical service—enables the machine to do its best work! Pure corkboard insulation sealed with hydrolene is used in all McCrays. No changes are required for machine installation.

McCray is the world's largest builder of refrigerators for all purposes—in food stores, markets, hotels, restaurants, clubs, hospitals, institutions, florist shops, and homes.

Dealers in mechanical refrigeration are invited to write for information regarding the McCray line. No obligation.

McCRAY REFRIGERATOR SALES CORPORATION
Dept. 66, Kendallville, Ind.
Salesrooms in All Principal Cities *{See Telephone Directory}*

WORLD'S LARGEST MANUFACTURER OF REFRIGERATORS FOR ALL PURPOSES

McCRAY REFRIGERATORS

ELECTRIC REFRIGERATION NEWS

The Business Newspaper of the Refrigeration Industry

PUBLISHED EVERY TWO WEEKS BY

BUSINESS NEWS PUBLISHING CO.

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APRIL 10, 1929

Refrigeration History

MUCH space in this issue is taken up with the proceedings of the recent patent trial between the Frigidaire and General Necessities corporations. The details of the testimony on both sides are not only of interest as news of great importance to the industry but also as a history of the development of electric refrigeration and as a question-and-answer course of study in the theory and mechanics of the art. The News considers this record as the most illuminating treatise on refrigeration ever published.

Since the patents in suit involved broad claims covering basic features of the design of domestic electric refrigerators as made by many companies now in the field, the outcome of the trial has been awaited with the keenest interest by engineers and manufacturing executives. The suit has been hanging fire in the courts for nearly three years and during this period the uncertainty regarding the validity of the patents in suit has undoubtedly had considerable effect upon the progress of the industry. While many who have made a careful study of the patent situation have been confident that the claims in certain patents would not withstand court action, no doubt bankers and investors have been, in some degree, hesitant to risk heavy investment until the validity of the patents was determined.

Evidence that the information contained in the court records is of real interest to the industry was shown by the fact that several manufacturers, not directly involved in the suit, had observers on hand during the entire week of the trial and made arrangements to secure copies of the complete proceedings. Since the announcement, in the previous issue of the News, that the record would be printed in full, many orders have been received for copies of the supplement and many new subscriptions carry the request to include the two issues containing this material.

In presenting the testimony and exhibits the News has taken pains to avoid any expression of opinion as to the merits of either side of the case . That was the function of the Court. The News has endeavored to give, as accurately as possible, the facts as recorded. It has been suggested that some of the witnesses might have preferred to have certain portions of the testimony suppressed but when we consider that the trial was entirely public and that each witness was under oath we can only assume that each spoke according to the best of his knowledge and ability. It will be understood of course, that minor mistakes were made by the reporters and that witnesses were often confused by the rapid fire of questions directed at them by the lawyers. While it is obvious that the witnesses spoke more freely under the direction of sympathetic counsel and that they "tightened up" under the cross-examination of a belligerent attorney, it is fair to say that both sides made a sincere effort to give the Judge a clear understanding of the fundamental principles of refrigeration. It is this part of the testimony, rather than the legal bickering which makes the account of the trial valuable to the industry at large.

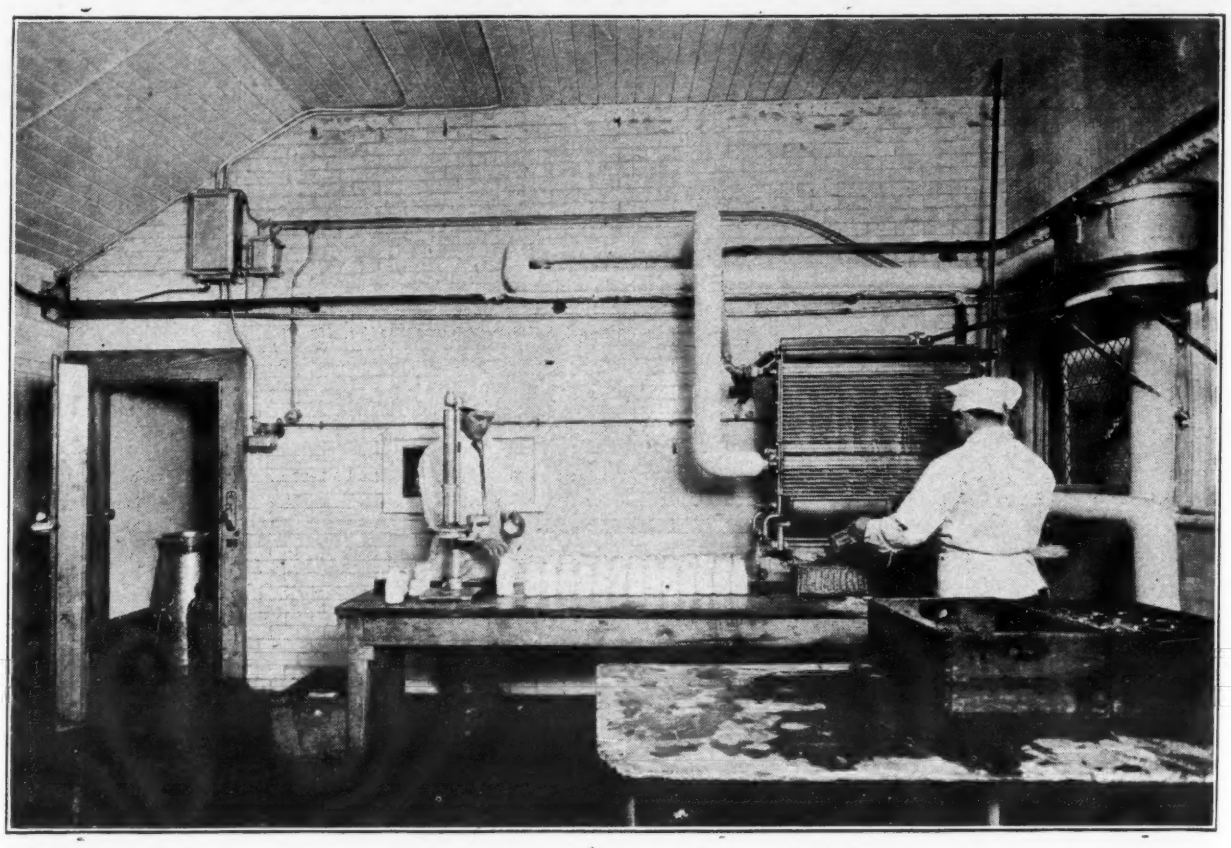
Readers will be impressed with the opened-mindedness of Federal Judge Tuttle and his keen interest in all the minutiae pertaining to the refrigerating mechanism. Frequently he plied the expert witnesses with questions which put their knowledge of the subject to a severe test. On several occasions they found it necessary to refer to text books or confess lack of exact knowledge on the point in question. But even the Judge agreed that the electric refrigerator is a complex device and that the whole subject was more difficult to comprehend than any which had come before him in other cases in which mechanical devices were concerned.

Students of electric refrigeration, particularly those interested in engineering, production, installation and service, will find in the testimony of expert witnesses in this trial a most interesting exposition of the physical laws and mechanical principles applied in the design and operation of refrigeration equipment. The record will also be of great value to salesmen and others in the industry who should have an adequate understanding of the subject but who have found it difficult to master the text books and technical literature.

In order to supply the demand for extra copies of the trial record, Electric Refrigeration News will reprint the complete proceedings in the form of a special supplement. The reprint will include all matter pertaining to the suit which appears in this and the preceding issue with some additional data bearing on the case. Only a limited number of copies of the special supplement will be printed and will be available at one dollar ($1.00) each postpaid.

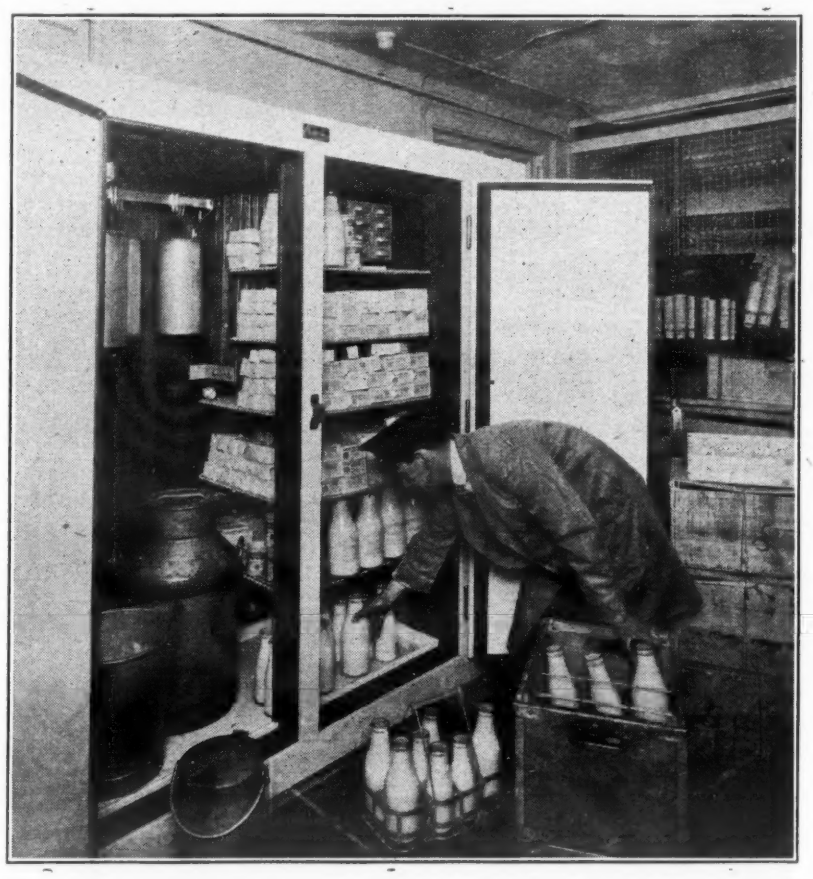
The expense of publishing this document will amount to several thousand dollars. For example, it cost the News about $400 to secure a copy of the 1000-page typewritten transcript of the trial. Many hours of editorial time were consumed in reading the copy, correcting typographical errors and injecting explanatory headings. One hundred and fifty galleys of linotype matter was set, photographs and engravings were made, then came extra printing, paper and postage. The whole work is a good example of the service rendered by a highly specialized business paper serving a single industry.

elvinator and Electrolux Work Together in Keeping Milk Sweet for London Dairy Company



The Express Dairy Co., Ltd., London, England, uses both gas and electric refrigeration. In the installation shown above Kelvinator LB and BB condensing units are used in cooling the warm milk as it comes from the dairy barns and in storing the surplus.

In the lower picture an Electrolux is shown in use in one of the dairy's branch stores in London. This model has 45 cubic feet capacity. It will hold 80 pint bottles of milk, eight one-gallon cream cans, and two large milk cans besides a large stock of butter.



English "No Boric Acid" Law Presents New Problem in Milk Preservation

By Dorothy Dignam,
European Correspondent

THE recent tightening of the British pure food law, again greatly restricting the use of preservatives in food products, has proved the biggest stimulus to the refrigeration market that the industry in Great Britain has thus far enjoyed.

The dairy interests were probably the first to feel the effects of the new 1928 regulation. The use of boric acid in the milk had long been an accepted practise, a two percent solution being considered negligible in harmful effect.

Official investigation revealed, however, that this addition sometimes rose to as high as twenty percent, in various foodstuffs. The dairy industry probably kept their percentage lower than the average. And the milkman, of all persons, might be least blamed for using preservatives as the mild, murky climate of England hastens the "turning" of even the freshest milk and often makes necessary a partial sterilization by heat at added cost and loss of time.

The dairy industry in Great Britain, however, occupies a place of national importance because of the many children in densely populated England. The population of the island, in fact, has tripled in the last hundred years and the large cities literally swarm with little folk. The proper nourishment of these future subjects of the King is very close to the heart of the nation and a "drink more milk" campaign is continually carried on. The dairy interests have allied themselves with this movement, of course, and on the passage of the "no preservatives" bill they demonstrated good spirit by wholeheartedly conforming to the new regulations.

The use of cold to retard the growth of bacteria was highly recommended by a committee from the Ministry of Health, their report stating that refrigeration was probably the most effective substitute for preservatives. Mechanical refrigeration has been applied to the problem in the dairy industry in several ways.

It is used first for cooling the milk at the dairy farm. Then for preserving it until ready for shipment. And finally, at the place of sale or the depot from which deliveries are made, mechanical refrigeration is again applied.

Both electric and gas appliances are employed for these several purposes and sometimes one dairy will make use of both methods.

The Express Dairy Company, Ltd. for instance, with stores throughout London, ordered an Electrolux gas operated refrigerator in March, 1926, as an "experiment." The following year, however, they bought fifteen additional models for their branch milk depots and have recently placed an order for six new models.

On the other hand, Kelvinator equipment is used in the cooling and storing of the milk on their certified dairy farms. Kelvinator has also equipped a number of city bottling depots with this same combination of milk cooler and storage plant.

The regular commercial cabinet installations are very popular in the dairy industry because of the ice produced in addition to the preservation of milk and butter.

One dairyman in Buckinghamshire reports that his gas-operated Electrolux produces forty pounds of ice a day, which is sufficient to freeze a supply of ice cream. A cafe in London uses the ice cubes from their milk refrigerator to surround the individual bottles of milk which are served from the counter. Formerly ice had to be purchased for this purpose.

All of these little economies are carefully noted and brought to the attention of the refrigerator prospect in Great Britain, and 60 to 80 percent of the business there is in large commercial sales.

COMMENTS ON THE NEWS FROM THE DAILY MAIL

"Above everything else about your paper, I admire the impressive manner in which you have represented the industry and we can imagine that it has been rather difficult to do this at times. Of all the trade magazines and papers which I receive, I will honestly say that REFRIGERATION NEWS is the only one I read from 'kiver to kiver'."—H. L. Schmutz, manager, Refrigeration Dept., American Electric Co., St. Joseph, Mo.

"Please accept my hearty congratulations on your issue of the 27th., ult. Your paper has indeed again shown its great value to the industry by your publishing the proceedings of the suit of the 'Frigidaire Corporation of Dayton, Ohio, plaintiff, vs. General Necessities Corporation of Detroit, Mich.', given before Judge A. J. Tuttle."—Fremont Wilson.

"I was agreeably surprised at the enormity and excellent make-ups of the New Equipment number of the ELECTRIC REFRIGERATION NEWS. You folks are certainly to be commended for your progressive program." — E. P. Sorensen, president, Utilities Engineering Institute, Chicago, Ill.

"Your issue of March 13th contains invaluable information for refrigeration and refrigerator manufacturers."—E. L. Pfister, Gloekler Manufacturing Co., Erie, Pa.

"Your March 13 issue of the News is certainly a 'corker'."—A. C. Mayer, manager, merchandising service division, General Electric Co., electric refrigeration department.

"It's a real paper; it informs, educates, and advertises, three in one."—Raymond R. Cox, Bryn Mawr, Pa.

"Your paper has had a steady increase in size and appearance and each issue is very interesting and we look forward to its arrival here."—F. L. Northey, pres., Northey Mfg. Co., Waterloo, Ia.

Patent Suit of Frigidaire vs. General Necessities

Court Record of the Trial Continued from March 27 Issue

PATENT SUIT RECORD IS A TREATISE ON REFRIGERATION

Judge Tuttle Takes an Intensive Six Day Course of Study in Electric Refrigeration

IN the preceding issue of Electric Refrigeration News, March 27, was reported the decision of Federal Judge Arthur J. Tuttle in the patent suit of the Frigidaire Corp. versus the General Necessities Corp. following a six-day trial in the district court for the Eastern District of Michigan at Bay City, Mich., in which patent No. 1337175 originally granted to Fred W. Wolf, April 13, 1920, was declared invalid. In addition to a stenographic record of the opinion of the court rendered by Judge Tuttle immediately following the close of the trial, Saturday, March 23, 1929, the complete proceedings during the first day of the trial, Monday, March 18, were published in full.

In this issue the proceedings of the remaining five days are given in full with explanatory notes and reproductions from some of the important patents and exhibits which were discussed during the trial.

Federal Judge Tuttle started the trial with no apparent knowledge of refrigeraion. Expert witnesses endeavored to explain it to him so that he might render an intelligent verdict regarding the merits of the claims by the plaintiff and the defendant. The Judge readily grasped some of the elements by making comparisons with things within the experience of laymen. On obscure points he asked questions and demanded reiteration until it was entirely clear to him. Details which the Judge found difficult to understand are, no doubt, the same that have puzzled many others. A careful reading of the questions and answers will be well worth the time and effort to anyone who is not satisfied with his present knowledge of the subject.

PROCEEDINGS DURING SECOND DAY OF TRIAL

UNITED STATES OF AMERICA IN THE DISTRICT COURT OF THE EASTERN DISTRICT OF MICHIGAN NORTHERN DIVISION

In Equity No. 1611

Frigidaire Corporation, Plaintiff, vs. General Necessities Corporation, Defendant.

Testimony taken and proceedings had in the hearing of the above entitled cause before the Hon. Arthur J. Tuttle, District Judge, beginning on Monday, March 18, 1929, at Bay City, Michigan.

Appearances:
Messrs. Cooper, Kerr & Dunham,
By Drury W. Cooper, Esq., and Thomas J. Byrne, Esq., and
Harry E. Lindsay, Jr., Esq.
Appearing on behalf of the Plaintiff.
Messrs Dean & Frye.
By George Rex Frye, Esq.
Appearing on behalf of the Defendant.

Tuesday, March 19, 1929
10:00 o'clock a. m.

Court convened pursuant to adjournment.

Parties present as before.

Mr. Cooper: Yesterday, Mr. Harlan referred to the fact that in the refrigerator like exhibit 9, put out by the plaintiff, under cross examination he said there had been some change in the condensing coils, and I promised to procure one of the condensing coils to which he was referring, and I produce it here now. I don't know as any other proof will be required, even of my statement that I had the size of the coils calipered, and they are 3/8 of an inch, and they are tinned on the outside, copper tinned on the outside.

The Court: This would be the gas in this part and the liquid here, would it not, from the testimony?

Mr. Cooper: Yes.

The Court: The bottom part would have liquid in it and the top would be gas. And these fins are little cavities in it.

Mr. Cooper: No, no cavities at all.

The Court: Just for giving off heat?

Mr. Cooper: Well, radiation, that is all.

The Court: They are giving out heat, not taking it in?

Mr. Cooper: I would have to refer that to Mr. Sessions.

Mr. Sessions: That is correct, yes.

The Court: They are giving out the heat, then.

Mr. Sessions: Yes.

Mr. Cooper: If anybody scratches that, they can find the copper on the coil.

The Court: Those fins, how much do they increase the power of the surrounding air to take up the heat that is in the radiator? How great is that? How much does that increase it?

Mr. Sessions: It is roughly proportional to the increase in the interior surface, but not exactly. I could not tell you exactly.

The Court: It is very much less than it would be if those could be built so they were hollow—of course that would not be mechanically possible, but suppose they were hollow and the liquid was out in there and you had correspondingly increased the surface for the gas and liquid on the inside to come in contact with it, it would be very much greater than it is this way.

Mr. Sessions: Except, your Honor, that there would be difficulty in having any movement of the liquid through those recesses on the side, that is, these hollow veins would not pass any of the gas, they would be pockets. It is the traveling of the gas through these pipes and impinging against the surface that delivers the heat to the metal of the pipe, from which it is transmitted to the air.

The Judge asks: "Would my coffee cool much faster if I had fins on my cup?"

The Court: Would my coffee cool much faster if I had fins on the cup?

Mr. Sessions: If you had a metal cup, yes, but with a porcelain or china cup I doubt if it would make any particular difference.

The Court: But if you had a metal cup and put your fins on the cup it would increase it—

Mr. Sessions: Yes, very much.

The Court: The reason is, of course, because the cup is taking up the heat from the liquid inside, and then the cup gives off heat much faster by having the fins on it.

Mr. Sessions: To the air; yes, sir.

The Court: I was making the mistake of thinking about the giving off of heat there—I was thinking of the wall being absolutely a wall against heat, but the wall takes up the heat and in turn gives it off. Your suggestion about my porcelain cup clears up in my mind entirely, because the porcelain cup is a more complete wall than metal.

Mr. Sessions: It is a very good heat insulator as such, it is not a perfect insulator but it is a heat insulator, it does insulate the heat. If you had the fins on your cup vertically it would cool faster than if it was horizontal, because there would be a current of air passing up through between the fins, and in that way the condenser, the air is blowing across the coils through these spaces between the fins.

Mr. Cooper: I will offer this radiator in evidence as Plaintiff's exhibit 13.

(Exhibit marked by reporter "Exhibit 13.")

The Court: I never had any patent cases where I think I was as much concerned as anywhere near this problem you have in this case, so I am doing a little extra visiting about it. In these bread wrapping machines, and all that, we have heating and cooling problems, but it does not involve this principle much, that you have to deal with here.

Further testimony by Frank L. Sessions, expert witness for Frigidaire Corp.

Frank L. Sessions was thereupon recalled as a witness on behalf of the Plaintiff and having been previously duly sworn, testified further as follows:

Cross Examination

By Mr. Frye:

Q. While this newly offered radiator is fresh in his Honor's mind, I would like to ask a couple of questions on it: Would it work just as well with S02 or Methyl Chloride or the others that you have mentioned as refrigerants?

The Court: The original files are now here if you want them. I did not bring them up and they were in Detroit, and they are in here now if you want them.

Mr. Frye: Very well, thank you.

Mr. Cooper: We are glad to have them here. We may have use for them.

A. I presume you refer to the cooling effect.

Q. When I say, "Would it work just as well?" I mean as a condenser in the machine such as plaintiff's or those that are in the court.

A. With the same differences of temperature between the gas within the condenser and the air outside, and the same velocity of air over the condenser, there would be the same heat transferance from the gas inside to the air outside.

Q. Are we to understand from that, that there is no advantage when it is up to the same atmospheric conditions? You say that with the conditions the same, there would be the same effect. Is there any special advantage in either of these that you desire to call attention to?

A. In either of what?

Q. The old and the new type radiators, condensers.

Mr. Cooper: You mean with respect to one another in comparison with one another?

Mr. Frye: Yes. If he has anything to say about them, I would like him to put them on the record.

A. The new type condenser with the increased radiating surface of the fins has a greater capacity for the space it occupies. That is, will transmit more heat through it, and the heat will be dissipated in the air in greater amount, in the same time, than if the tube alone be used without the fins.

Q. Are we to understand from that that you can use a shorter length of tube with the new radiator and get the same results?

A. I think there may be a difference in the length of the tube; I think it would be a shorter length, yes.

Q. In the new radiator?

A. Yes.

Q. Don't you know that it is considerably shorter?

A. I have not measured it.

The Court: Now, as to the old, you are speaking of what?

Mr. Frye: The one that is in the plaintiff's device in court, or the one that is in the defendant's device. I don't care which he refers to, but both of them, I understand, are the old type coils. Now, it is the new one with the fins—

The Court: Fins on it?

Mr. Frye: Yes.

The Court: In other words, the comparison is simply with and without fins.

Mr. Frye: Well, I wanted to give him the opportunity to bring out whatever data he has. So far, as I get it, he says that it will cool with greater rapidity with the same length of tubes, or I imagine as a corollary, that you can use a shorter length of tube in the new one; but if that is not the fact, I would like him to correct me.

The Witness: It is a fact, so far as I know. They both have the same sized tubing.

Q. In cross section, but not in length, is that true?

A. No, not in length. Length is naturally made suitable to secure the dissipation of heat that is desired.

Q. Well, is there any way known to you, as a mechanical engineer, for computing what length of tube would be needed in either of the radiators before you?

A. Only from empirical data.

Q. Well, don't you know where to secure such empirical data?

A. No, I do not.

Q. Yesterday, I believe, you made the statement that the Wolf patent was the only known source to you for obtaining data concerning proportions, if I remember your words, whereby a certain result can be obtained from the combination of the claims. Now I would like you to tell us in a little greater detail what proportions Wolf has set out.

A. The proportions I referred to or had in mind particularly were those of the condenser tube, a copper tube of about three-eighths inch in diameter with a comparatively thin wall, and of sufficient length to dissipate the heat as desired.

Q. Well, proportion must be relatively to something else. What are you referring that size tube to?

A. Length and diameter are the proportions that I have in mind.

Q. Well, to?

A. Length and diameter.

Q. Well, we will admit that you have got a certain size on your condensing coil. Now, that is proportionate to what?

A. To itself. The proportions, the relative proportions of the length and diameter, of itself.

Q. Do you, as a mechanical engineer, usually use the term "surface area," in describing condensers?

A. It is used frequently, yes.

Q. And means length plus diameter, doesn't it?

A. No, it does not.

Q. Take the tube of the Wolf patent, what is the surface area of the condensing coil?

A. It is the circumference of the tube multiplied by the length that is exposed to the atmosphere.

Q. And you find the circumference through the diameter, don't you?

A. Yes, yes, that is a function of the diameter.

Q. Now, do you mean outer circumference or the inner circumference, or the size of both?

A. It depends upon which you state. It may mean either. You may mean the outer surface; the outer surface is ordinarily that which is considered in air-cooled—

Q. Which do you mean when you have referred to them?

A. The outer surface. I frequently used the inner surface.

Q. Well, cannot either be used with appropriate length in computing what you want computed?

A. It depends upon what you want computed. Either can be used. It is simply a case of multiplying circumference by length.

Q. Now, we have reached the point where Wolf has told us the size of this particular one with, I take it, appropriate length. Does that length vary with refrigerants used?

A. I think it would have to, yes.

Q. Do you know whether there was any empirical data, as you have called it, concerning SO2, the refrigerant named in the Wolf patent, that would be available to you at the time that Wolf was filing his application?

A. For what purpose?

Q. For use in refrigeration machines?

A. Yes, there was data concerning the characteristics, the properties, of SO2.

Q. I am not speaking of chemical formulas or anything of that kind. I am speaking of the use of SO2 in refrigerating machines. Suppose that at the date of Wolf's entrance into the field, anyone like yourself, a skilled mechanical engineer, wanted to design a refrigerating machine using SO2, where would you look for the empirical data that you have talked of?

A. In text books, hand books and publications.

Q. Have you ever found any regarding that refrigerant in your searches?

A. Nothing that would aid one in arriving at the results that Wolf arrived at.

Q. What do you consider those results to be, the use of SO2, or does it still have relation to the proportions?

A. Why, the results that Wolf accomplished was a household refrigerator of wonderfully efficient, compact and useful characteristics.

Q. Did you ever see one of them that was made by Wolf, or by a company of which Wolf was a part?

A. No.

Q. Did you ever hear of the Domelre Company?

A. I have heard of it, yes.

Q. Do you know what machine they attempted to manufacture?

Mr. Cooper: I think I will ask to have this question limited to the witness' personal knowledge.

Mr. Frye: I am asking, does he know what machine was attempted to be made by the Domelre Company?

The Witness: Only by hearsay.

Q. Well, do you know that that was the company that Wolf first endeavored to market the machine of the Wolf patent?

A. Only by hearsay. I have heard that to be the fact.

Q. You don't personally know?

Patent No. 187413 by Raoul Pictet, dated Feb. 13, 1877, is introduced.

A. No.

Q. I would ask you to examine a patent of Raoul Pictet, number 187413, patented February 13, 1877, and ask you whether you think that would be empirical data that would enable a skilled engineer to use SO2 in refrigerating machines?

Mr. Cooper: Is this something set up in your answer?

Mr. Frye: I don't care if it is or not.

Mr. Cooper: I asked you the question. I don't like to be insulted.

Mr. Frye: I did not intend that. I don't know, and I don't care, because I am not using it for that purpose.

Mr. Cooper: If your Honor please, I do not see the propriety of continuing to ask the plaintiff's witness to develop the prior art for the defendant. Of course, it is all under my objection, whatever answer they get they are bound by; but be that as it may, it seems to me that it is not an orderly way of trying a case.

The Court: Well, on the state of the art, it is admissible; and while I take it from what you have said that Sessions is the only expert you expect to call on the subject, sooner or later I would be glad to know what Mr. Sessions would have to say about that, and if they want to do it at this time, I don't think it will bother—I will permit it.

Mr. Cooper: May I ask him a preliminary question, then?

By Mr. Cooper:

Q. Mr. Sessions, are you familiar with this patent? Have you examined it?

A. I have not.

The Court: Well, I recognize that for a witness to examine it thoroughly, if he makes an answer that he later wants to change, I would not discount his testimony very much on that account.

Mr. Frye: Your Honor, one purpose of this cross examination, of course, is an endeavor to show that Mr. Sessions is not the kind of a mechanical engineer that should interpret a refrigeration patent. We want to bring out his lack of knowledge, as well as his knowledge.

Mr. Cooper: I don't think that is the way to bring it out.

The Court: I will admit it for the other purpose because of the assistance I hope he will be able to give the Court about it, but I will let you ask the question and let him answer.

The Witness: May I hear the question, so that I may know what to look for?

(Question repeated by reporter.)

Mr. Cooper: May I have a copy of that patent?

The Court: They have talked about sulphur oxide. Does that mean sulphur dioxide?

Mr. Frye: We think, your Honor, it is SO2; anhydrous sulphurous oxide is H2 SO2 or 3, whichever happens to be the formula.

The Court: Well, H2SO4 is sulphuric acid?

Mr. Frye: Yes, exactly, and when you leave one off, it is sulfurous when you take the water out of the H20 it leaves S02, and I think this gentleman explains how the S02 is to be obtained, and how it is to be used.

Pictet patent points out the necessity of having sulphur dioxide free from water.

The Witness: This patent, 187413 points out the disadvantages of the use of ammonia, sulphuric ether, and air, as refrigerants; then points out the theretofore supposed disadvantages of sulphuric oxide, which is presumably sulphur dioxide, stating that the objection to the use of sulphurous oxide prior to the date of this application, which was June 28, 1878, was due to the fact that it would always contain water, and this inventor, Pictet, claims that by using the sulphur dioxide or sulfurous oxide that is free from water he is able to make satisfactory refrigerating apparatus; he calls attention to the advantages of the use of sulfurous oxide stating that, on page 2, paragraph—the second paragraph preceding the claim, the advantages of the use of this material for this purpose are that the pressure never exceeds four atmospheres, second there is never any entry of air to the water since the pressures up to 14 degrees Fahrenheit are always above that of the atmosphere, third the greasing of the machine with which the material comes in contact is dispensed with, the material itself serving as a lubricant, and if grease was used, it is not affected by the anhydrous material; fourth, the volatile liquid employed is perfectly stable, indecomposable and without action on metals; five, the volatile liquid is produced at a very low price, and it is unaccompanied by any danger of explosion or fire; sixth, by its use in the manner described ice can be produced at a very low rate.

There is a brief description of the apparatus, it is extremely brief. I will read it.

"In order, however, to produce the best results, I use a refrigerator constructed on the plan of a tubular boiler, with a large number of tubes, through which, as well as around the body of the vessel, the brine is caused to circulate so as to bring it in contact with as large a surface as possible, in order that the gas may absorb the heat as rapidly as possible; and, as a further aid to success, it is important that the brine should be caused to circulate rapidly through the tubes, of the refrigerator, and also among and around the vessels containing the liquid to be frozen or the articles to be cooled, and these conditions I have provided for in my improved apparatus, to which allusion has heretofore been made.

"By means of a pump the gas is drawn off from the refrigerator continuously as it is formed by the volatilization of the liquid, is recondensed, and again returned to the refrigerator, and thus the process is rendered continuous, the same material being used over and over repeatedly, the stability of character of the anhydrous sulphurous oxide rendering it specially capable of being so used."

Aside from the keeping that dry sulfurous oxide may be successfully used in a closed metal circuit, it is my opinion that this specification as it is written would throw an engineer into a great deal of difficulty in producing any kind of a refrigerating apparatus.

It says this material may be used without oil, and that I know is impossible. Sulphurous oxide is a lubricating agent, but if it is a lubricating agent it is insufficient.

The Court: But he says in there, if I understood correctly what you read, that it might be used with oil, because it would destroy the oil.

The Witness: Yes, it says greasing. The problem of oil is one that is interlocked with the problem of the condenser. In the Wolf patent, the patented structure, the size of a tube is of great importance in the matter of properly handling the oil.

The Court: He says nothing in there about the size of the tube, I take it?

The Witness: No, and the description of the apparatus is as follows:

"In the above drawings, figures 1, 2 and 3 represent the apparatus in which I propose to use the anhydrous sulphurous oxide for making ice, and figures 4 and 5 represent a modification of the same; more especially designed for use on shipboard."

I cannot see anything in that that would enable an engineer to design and build a refrigerating apparatus.

Q. And as to the size of the tube, what does Wolf teach?

The Witness: The cooling of the tube by a blast of atmospheric air or by atmospheric air without a blast.

The Court: A fan?

The Witness: Yes, either with or without the fan, and the combination of the compressing means with this condenser and the evaporator in the closed circuit, that is the condenser of a certain type.

Q. I will ask you to read a paragraph beginning, "Principle upon which cold is produced," from the Pictet patent.

A. This paragraph to which you refer is the second to the last paragraph on page 2 of the first column of page 2, and it reads:

"The principle upon which cold is produced in this case is by causing the liquified gas to enter a refrigerator, where its

Expert Witness Analyzes Wolf Patent

volatilization absorbs the heat from the brine in which the refrigerator is immersed in a tank, thereby reducing the temperature of the brine to a degree sufficient to congeal fresh water held in suitable vessels and immersed in the brine."

Q. Now, would you say as a mechanical engineer there is any difference in principle between the device of the Wolf patent and that of the Pictet patent?

A. Not in the principle of abstracting the heat and disseminating it, although the means of disseminating it are not shown in the Pictet patent, are not described.

Q. I believe you used the word "Theory" in your direct examination. Is your theory of refrigeration the same in the Pictet the difference of the Wolf patent.

A. Yes.

Q. In answer to his Honor's question a moment ago, you pointed out, as I remember it, two differences of the Wolf patent in suit over the Pictet patent, one of them being the cooling by a blast of cold air, I believe you said, with or without a blast of cooled air, and the other was an arrangement of a combination of the parts, which parts we wish you would tell us in specific detail.

Mr. Cooper: Now what is the question? I have heard a declamation. Do you want him to redescribe the Wolf patent?

Mr. Frye: We would like him in a brief way, if possible, to tell us what that combination is he has just told his Honor is the difference of the Wolf patent?

Mr. Cooper: I think it was fully described yesterday on cross examination—

The Witness: I have already discussed claim 10 and I presume from your question you desire me to discuss the other claims in suit?

Q. Not unless you want to.

Mr. Cooper: I don't like that kind of disposition.

Mr. Frye: We don't care how he does it, I would ask him to explain the combination of the Wolf patent. You made that statement in response to his Honor's question and I would like it enlarged.

Mr. Cooper: I would like counsel to distinguish between his orations and questions. Anybody who reads the question cannot tell what it means, it seems to me, and if counsel will keep his orations in reserve until we finish, I think we will get along better.

The Court: Do you understand the question?

The Witness: I understand Mr. Frye's language, but he puts a wrong slant upon my answer to your Honor's question. He states I said there was a combination. If you will have my answer to your Honor's question read you will find that I referred to the use of this condenser in combination with other things.

Mr. Frye: Well, if that is what you mean, let us have it. I am trying to have you enlarge upon it to the extent you desire. I thought we were quoting your particular answer to his Honor. If not we would like to read in the exact answer and ask you to point out the exact combination. Do you understand exactly what we want?

The Witness: I shall answer the question by analyzing the remaining claims in suit and point out the parts that are in combination.

Q. If you so desire.

A. I do so desire, as I see it is the only way in which I can answer your question. I have already analyzed and discussed claim 10, claim 15 reads,—"A refrigerating apparatus, including in combination,—" I will put in the elements as I come to them:

"Element 1. A compressor.

"Element 2. An air cooled condenser.

"Element 3. An expansion chamber.

"Said parts being connected to form a closed circuit for the refrigerating agent.

"Element 4. A fan, mounted to effect a circulation of air around the condenser and against the compressor." Against this claim there was a disclaimer which reads as follows:

Disclaimer filed by Frigidaire limits claim 15 of Wolf patent to condenser tubing of ½-inch diameter.

"A disclaimer from the scope of said claim 15 of the refrigerating apparatus so designed for an air cooled condenser composed of a considerable length of metal tubing of not more than one-half of an inch diameter and having a comparatively thin wall."

The class of apparatus, a refrigerating apparatus, is a household refrigerator, one for domestic purposes, as stated on page 1, line 13 of the specification. The compressor, which is the first element of the combination, is shown as a belt-driven compressor with a horizontal cylinder, but there is no limitation placed upon that element in the claim or in the specification.

The Court: You are reading from the Wolf patent.

The Witness: Yes, claim 15 of the Wolf patent.

The Court: You say in the Wolf patent—we were talking about in the Wolf patent, there were no illustrations as to the kind of compressor to be used. The second element, an air cooled compressor is of a specific construction in accordance with the patent teachings, a disclaimer limits this to an air cooled condenser based—composed of a considerable length of metal tubing of not more than one-half inch in diameter and having a comparatively thin wall.

The Court: I don't want to interrupt you, but I would like you to read to me the part in the specifications upon which that disclaimer is based. I do not readily turn to it; I know it is here.

The Witness: If you will refer to page 1, commencing with line 96, the paragraph reads, "A condensing coil adapted for air cooling as indicated at 20. It comprises a considerable length of tubing having a comparatively small cross section and a comparatively thin wall to obtain maximum cooling. I have found that the best results are obtained by using copper tubing of about three-eighths inch diameter. As shown the condensing coil is mounted above the refrigerator and it is exposed to the air throughout its length between the compressor 13 and the expansion coil 12."

Then running down to line 16 of page 2, is the limitation or specification: "As many loops are used to make up the con-

(Continued on Page 21)

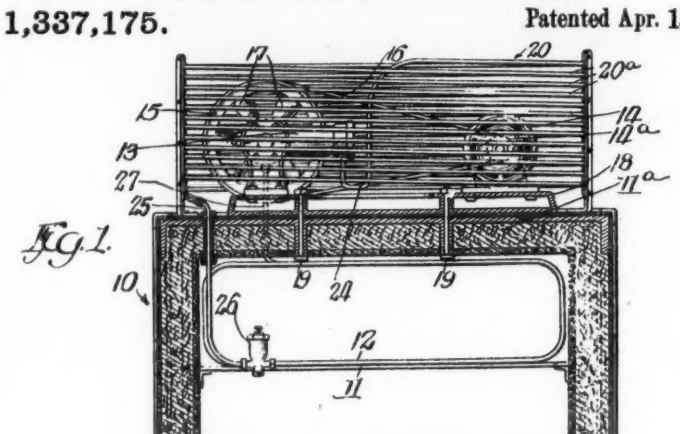
THE WOLF PATENT WHICH HAS BEEN DECLARED INVALID BY FEDERAL JUDGE A. J. TUTTLE

F. W. WOLF.

PROCESS OF AND APPARATUS FOR REFRIGERATING.

APPLICATION FILED DEC. 23, 1913. RENEWED DEC. 1, 1916.

1,337,175. Patented Apr. 13, 1920.



UNITED STATES PATENT OFFICE

FRED W. WOLF, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE ISKO COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE.

PROCESS OF AND APPARATUS FOR REFRIGERATING.

1,337,175 Specification of Letters Patent. Patented Apr. 13, 1920.

Application filed December 23, 1913, Serial No. 808,389. Renewed December 1, 1916, Serial No. 134,502.

To all whom it may concern:

Be it known that I, FRED W. WOLF, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Processes of and Apparatus for Refrigerating; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which forms a part of this specification.

This invention relates to refrigeration and particularly to processes and apparatus involving compression of the refrigerant as distinguished from absorption systems.

The invention is primarily intended to be used for domestic purposes and one of the objects is to obviate the various defects and disadvantages to be found in prior systems as used for refrigeration on a large scale or for the manufacture of ice in commercial quantities.

One of the disadvantages of prior compression systems is in the cooling of the refrigerant. Where running water is used to cool the condenser there is not only the expense involved in the installation and upkeep but the apparatus including the plumbing is very cumbersome and considerable difficulty is experienced in properly controlling the feed and disposal of the water, particularly if the pressure varies in the supply mains as is nearly always the case.

The present invention overcomes this serious disadvantage and it consists generally, in the use of a refrigerant of low boiling point such as sulfurous acid (SO_2), compressing such refrigerant and delivering it to a receiver, then cooling the refrigerant to something above the temperature of the air surrounding the receiver, and finally expanding the refrigerant to produce a refrigerating effect. By using sulfurous acid as suggested above and providing a large superficial area in the condensing coil, the refrigerant may be condensed and liquefied by exposing the coils to the air only and the use of cooling water is dispensed with.

The invention is further embodied in an apparatus for carrying out the process, and an illustrative form of such apparatus is shown in the drawings which form a part of this specification, and in which;

Figure 1 is a view of a refrigerating apparatus built in accordance with this invention shown as applied to a domestic type refrigerator, the latter being partly in section;

Fig. 2 is a plan view of the refrigerator and apparatus shown in Fig. 1;

Fig. 3 is an enlarged sectional view through the condensing coil on the line 3—3 of Fig. 2; and

Fig. 4 is a view on a still larged scale representing a cross section of the tubing forming the condensing coil.

In the drawings, 10 indicates a refrigerator which may be of any desirable construction, having a shelf 11 at the top to support an expansion coil 12. 13 indicates a compressor mounted on the top wall 11a of the refrigerator near one end thereof, and 14 a motor for driving said compressor mounted on said top wall near the other end thereof. 15 indicates a driven pulley adapted for the operation of the compressor. Said pulley is connected by one or more belts 16 to a driving pulley 14a on the shaft of the motor 14. The belts are preferably round in section and both the driven pulley 15 on the compressor and the driving pulley 14a on the motor have suitable peripheral grooves to receive said belts.

The driven pulley 15 is made heavy so as to act also as a flywheel and preferably has spokes 17 constructed to form fan-like, spiral blades which act to produce a draft over the top of the refrigerator and effect a continual change of the air in and about the apparatus thereon. The compressor and the motor, as shown, are mounted on a common, hollow base 18 which is attached by suitable bolts 19 to the top wall 11a of the refrigerator.

A condensing coil adapted for air cooling is indicated at 20. It comprises a considerable length of tubing, having a comparatively small cross section and a comparatively thin wall to obtain maximum cooling. I have found that the best results are obtained by using copper tubing of about ⅜" diameter. As shown the condensing coil is mounted above the refrigerator and it is exposed to the air throughout its length between the compressor 13 and the expansion coil 12. It comprises a plurality of vertically spaced, horizontally disposed loops 20a which surround the compressor and motor in the form of a cage, thus acting as a guard about the operating parts of the apparatus. In the drawings these loops 20a approximate in size and form the plan of the top wall 11a of the refrigerator and thus occupy a maximum of horizontal space without extending beyond the refrigerator and a maximum length of tubing is included in each loop. As many loops are used to make up the condensing coil as will be required to properly cool and liquefy the refrigerant and it is found that by the construction and arrangement described the loops will not need to extend any substantial amount above the top of the flywheel or pulley of the compressor, so that the apparatus as a whole will require a minimum height in the space that it occupies. At the same time, by making the condensing coil, as shown, of substantially the same plan as the top wall of the refrigerator and forming it of tubing of small cross section and of thin metal, a maximum of radiating surface is provided in the coil and air cooling is sufficient to efficiently condense and liquefy the refrigerand therein.

The plurality of loops are supported in any convenient manner, and, as shown, are attached to upright bars 21 located at the corners of the top of the refrigerator. Said loops are connected to said bars by means of plates 22, having a plurality of vertically spaced, semi-circular parts 23 which engage the several loops and hold them in proper vertically spaced relation.

The top coil has an inlet end 24 which is led down and connected to the compressor in such manner as to receive the compressed refrigerant from the cylinder of said compressor. The bottom coil has an outlet end 25 which is led down through the top wall of the refrigerator and is connected by an expansion valve 26 of any suitable construction to the inlet end of the expansion coil. 27 indicates the outlet end of the expansion coil which is led up through the top wall of the refrigerator and is connected to the compressor in a familiar manner.

By constructing the driven pulley on the condenser with the fan-like spiral blade spokes as described, a proper circulation of air between the coils is produced when, as is often the case, the refrigerator is placed under an overhanging shelf with its back against one wall and its two sides in close proximity to offsets in said wall.

By the arrangement of the condensing coil as described, the rapidly moving parts of the apparatus are completely inclosed, so that no danger is incurred by those approaching the refrigerator.

I claim as my invention:

1. In a refrigerating apparatus adapted for the use of a refrigerant of low boiling point, in combination with an expansion coil, a compressor, a motor for driving said compressor, means for supporting said motor and compressor in operative relation, a condensing coil made of tubing of comparatively small cross section and having a comparatively thin wall, said condensing coil being exposed to the air and comprising a plurality of vertically spaced, horizontally disposed loops surrounding said motor and compressor, and means for supporting said loops in proper vertically spaced relation.

2. In a refrigerating apparatus adapted for the use of a refrigerant of low boiling point, in combination with a refrigerator, a compressor located on top of said refrigerator, a motor for driving said compressor located on top of said refrigerator and an expansion coil located within said refrigerator, a condensing coil made of tubing of comparatively small diameter having a comparatively thin wall, said condensing coil being adapted to be air cooled and comprising a plurality of vertically spaced, horizontally disposed loops surrounding said motor and compressor, and means rising from the top of said refrigerator adapted for supporting said loops in proper vertically spaced relation.

3. In a refrigerating apparatus adapted for the use of a refrigerant of low boiling point, in combination with a refrigerator, a compressor located on the top of said refrigerator, a motor for driving said compressor located on top of said refrigerator, and an expansion coil located within said refrigerator, a condensing coil consisting of a plurality of vertically spaced, horizontally disposed loops made from tubing of comparatively thin metal, said tubing being of comparatively small diameter, the figure inclosed by said loops being substantially equal to the top plan of the refrigerator, and means rising from the top of said refrigerator adapted for supporting the loops of said coil in proper vertically spaced relation.

4. In a refrigerating apparatus adapted for the use of a refrigerant of low boiling point, in combination with a refrigerator, a compressor located on the top of said refrigerator, a motor for driving said compressor located on top of said refrigerator, and an expansion coil located within said refrigerator, a condensing coil consisting of a plurality of vertically spaced, horizontally disposed loops made from tubing of comparatively thin metal, said tubing being of comparatively small diameter and having its outer surface tinned, the figure inclosed by said loops being substantially equal to the top plan of the refrigerator, and means rising from the top of said refrigerator adapted for supporting the loops of said coil in proper vertically spaced relation.

5. In a refrigerating apparatus, in combination, a compressor, a motor for driving the compressor, an expansion coil connected to the compressor, and a condensing coil exposed to the air and connected to the compressor and to the expansion coil, said condensing coil comprising a plurality of vertically spaced loops forming a cage around said compressor and motor.

6. In a refrigerating apparatus, in combination, a compressor, a motor for driving the compressor, an expansion coil connected to the compressor, and a condensing coil exposed to the air and connected to the compressor and to the expansion coil, said condensing coil comprising a plurality of vertically spaced loops forming a cage around said compressor and motor, and a fan inside said cage to circulate the air about said condensing coil.

7. In a refrigerating apparatus, in combination, a support, a compressor and a motor mounted thereon in spaced relation, means for driving the compressor from the motor, an expansion coil connected to the compressor and extending below the top of said support, a condensing coil exposed to the air above the top of said support and connected to the compressor and to the expansion coil, said condensing coil comprising a plurality of vertically spaced loops forming a cage around said compressor and motor, and means for supporting said loops in spaced relation from the said support.

8. The combination with a refrigerator, of a refrigerating apparatus, adapted for the use of a refrigerant of low boiling point and comprising an expansion coil in the refrigerator, a base mounted on the refrigerator, a compressor and motor on said base, a driving connection from the motor to the compressor, and a condensing coil exposed to the air and supported above the top of said refrigerator, said condensing coil being connected to the compressor and to the expansion coil and comprising vertically spaced loops surrounding said compressor and motor.

9. A refrigerating apparatus employing sulfur dioxid as the refrigerating agent comprising in combination, means to compress the sulfur dioxid gas, an atmospherically cooled condenser for condensing the compressed gas, and an expansion chamber into which the condensed liquid is expanded, said parts being connected to form a closed circuit for said agent.

10. A refrigerating apparatus comprising in combination, means to compress a refrigerating gas to a pressure, the corresponding boiling point of which is above the temperature of the atmosphere, an atmospherically cooled condenser for condensing the compressed gas, and an expansion chamber into which the liquid is expanded, said parts being connected to form a closed circuit for the refrigerant.

11. A refrigerating apparatus comprising in combination, a gas compressor, atmospherically cooled condensing means disposed on at least two sides of said compressor to condense the compressed gas and an expansion coil, said parts being connected to form a closed circuit for a refrigerant.

12. A refrigerating apparatus comprising in combination, a gas compressor, atmospherically cooled condensing means to condense the compressed gas, means directly connected to the compressor to effect a circulation of the atmosphere around said means, and an expansion chamber into which the condensed liquid is expanded.

13. A refrigerating apparatus comprising in combination, a gas compressor, atmospherically cooled condensing means to condense the compressed gas, a fan rotating at the same speed as the compressor to effect a circulation of the atmosphere around said means, and an expansion chamber into which the condensed liquid is expanded.

14. A process of refrigeration consisting in, compressing sulfur dioxid gas, atmospherically cooling the compressed gas to condense the same, and expanding the condensed fluid into an expansion chamber to produce a refrigerating effect.

15. A refrigerating apparatus including in combination, a compressor, an air cooled condenser, and an expansion chamber, said parts being connected to form a closed circuit for the refrigerating agent, and a fan mounted to effect a circulation of air around the condenser and against the compressor.

16. A refrigerating apparatus including in combination, a compressor, an air cooled condenser, and an expansion chamber, said parts being connected to form a closed circuit for the refrigerating agent, a motor having a shaft connected to the compressor to drive the same, and a fan mounted to effect a circulation of air around the condenser also driven by said motor.

17. A refrigerating apparatus including in combination, a compressor, atmospherically cooled condenser means, an expansion chamber, and a fan arranged coaxially with the driving shaft of the compressor to effect a circulation of air around the said means.

18. A refrigerating apparatus including in combination, a compressor, atmospherically cooled condenser means, an expansion chamber, a motor to drive said compressor, and a fan mounted to rotate about an axis parallel to the motor and driven thereby to effect a circulation of air around the said means.

19. A refrigerating apparatus including in combination, a compressor, atmospherically cooled condenser means on opposite sides of said compressor, an expansion chamber, a man to effect a circulation of air around said means and a motor connected to drive said compressor and fan.

20. A refrigerating apparatus including in combination, a compressor, atmospherically cooled condenser means comprising a coil arranged in loops surrounding the compressor, an expansion chamber and means to drive the compressor.

21. A refrigerating apparatus including in combination, a compressor, atmospherically cooled condenser means comprising a coil arranged in loops surrounding the compressor, a fan to effect a circulation of air around the coil, an expansion chamber, and means to drive the compressor and fan.

22. A refrigerating apparatus including in combination, a compressor, atmospherically cooled condenser means, an expansion chamber and a motor to drive said compressor, said means comprising a coil arranged in loops surrounding the compressor and motor.

23. A refrigerating apparatus including in combination, a compressor, atmospherically cooled condenser means, an expansion chamber, a motor to drive said compressor, said means comprising a coil arranged in loops surrounding the compressor and motor, and a fan driven by the motor to effect a circulation of air around said means.

In testimony that I claim the foregoing as my invention I affix my signature in the presence of two witnesses, this 17th day of December, A. D. 1913.

Witnesses: FRED W. WOLF.
GEORGE R. WILKINS,
KARL W. DOLL.

PAGE 2

PAGE 3

PAGE 4

Claims 15, 16 and 18 of Wolf Patent

(Continued from Page 20, Column 1)

densing coil as will be required to properly cool and liquify the refrigerant."

That is the basis on which the disclaimer was filed, as I understand it.

The Court: All right.

A. (Continuing.) The third element, an expansion chamber, is the coil 12. This is shown as a coil of tubing, but the claim does not limit the expansion chamber to the form of a coil. The reference in the specification to this expansion chamber is in the first part of the paragraph on page 1, commencing with line 68. It reads:

"In the drawings, 10 indicates a refrigerator which may be of any desirable construction, having a shelf 11 at the top to support an expansion coil 12."

On page 2, this member is again referred to as an expansion coil, in line 51, but any form of expansion compartment or chamber may be used, as I understand this expression in the claim.

Then the clause which specifies the connection of these parts, reads: "Such parts being connected to form a closed circuit for the refrigerating agent." The circuit for the refrigerating agent is from the compressor 13 to the condenser 20, from the condenser, through the expansion valve 26, into the expansion chamber or coil 12, and from the expansion chamber 12 back to the compressor 13, there is a closed circuit for the refrigerant.

The last item is a fan mounted to effect a circulation of air around the condenser and against the compressor. This fan consists of the inclined blades or spokes of the flywheel, 15. These blades are numbered 17 in the drawings and are shown clearly in figure 1 as being of the propeller type of fan blade.

That completes the analysis of claim 15.

Claim 16 of Wolf patent, No. 1337175, one of four (Nos. 10, 15, 16 and 18) on which infringement was charged.

Claim 16 reads: "A refrigerating apparatus including in combination (element 1) a compressor; (element 2) an air cooled condenser, (element 3) an expansion chamber.

Then the defintion of the connection reading: "Said parts being connected to form a closed circuit for the refrigerating agent." And (Element 4) a motor having a shaft connected to the compressor to drive the same and (Element 5) a fan mounted to effect the circulation of air around the condenser, also driven by said motor.

This claim is like claim 15, with the introduction of the motor and a fan driven by the motor. The drawing shows the fan as built in as part of the fly wheel, but this claim includes any mounting of the fan which may be driven by the motor, and it also includes the motor that has a shaft connected to the compressor to drive the same. That is, I understand by the term "Connected" any form of power transmitting connection. It is connected by a belt through pulleys in the drawing.

I will not discuss the first three elements of the claim, as they are the same as those in claim 15. I will now read claim 18:

"A refrigerating apparatus including in combination (Element 1) a compressor, (element 2) atmospherically cooled condenser means, (element 3) an expansion chamber, (element 4) a motor to drive said compressor, and (element 5) a fan mounted to rotate about an axis parallel to the motor and driven thereby to effect a circulation of air around the said means.

This claim has the first three elements of claim 18.

I should have stated in connection with claim 16 that there is no disclaimer as to the form of condenser used. Claim 16 calls for an air cooled condenser, and claim 18 calls for an atmospherically cooled condenser means, and in neither of the claims 16 or 18 is there any limitation as to the form of the condenser to be used, such as has been imposed upon claims 10 and 15 by the disclaimers filed.

The fan in claim 18 is specified to be mounted to rotate about an axis parallel to the motor and driven thereby to effect a circulation of air around the said means—referring to the condenser means. This claim is broad enough to include any fan that may be upon a shaft parallel to the motor shaft; it may be upon an idler shaft, driven by the belt which passes from the motor to the compressor, it may be upon the motor shaft itself, it may be upon the compressor shaft or any other shaft, but would not include a shaft, for instance, at right angles to the motor shaft.

The Court: What was the object in limiting that in the patent?

The Witness: I don't know what was the object, but it makes it a definite declaration that any use of a fan having an axis parallel to the motor shaft; now, that is the most mechanical, the most advantageous position in which to put the fan, and I presume the claim was drawn to cover that most advantageous arrangement.

Lowe patent No. 63413, issued April 2, 1867, describes carbonic acid machine.

By Mr. Frye (Resumed):

Q Yesterday you were reading a patent to Lowe, number 63413, in 1867, and your eyes bothered you so that you could not read that one. I happen to have a photostat that is enlarged slightly, and if it does not hurt your eyes I wish you would answer one or two questions in connection with it.

Mr. Cooper: That is all subject to my objection.

Q First of all, we would like you to read into the record, how he describes the cooling of his condensing means.

A On the first page of the specification in the fourth paragraph it reads as follows: "The latent heat evolved during the process of mechanical compression should be removed by a running stream of water, or by a blast of cool air, or other equivalent means applied to the compressing pump or tubes, reservoir or chamber, proceeding from or connected with a compressing pump."

The paragraph continues: "The water to be frozen or the material to be cooled should be brought into intimate contact with the tube or vessel containing the carbonic acid or equivalent material while vaporizing or passing from the liquid to the gaseous state."

Now the condenser is described. On page 2, the fifth line from the top, it refers to the part E, which I take it is the condenser. It reads: "It is then led into the coil in the Receiver E, where the requisite pressure to convert the gas to a liquid state is maintained, say for carbonic acid gas about 40 atmospheres,"—that would be 600 pounds to the square inch,—"the gas slowly condenses into a liquid which forms in the bottom of the coil. The parts being properly constructed, this liquid may be retained under pressure indefinitely. The means for cooling the compressed gas is by a stream of water or by a blast of cooling air applied to the compressing pump or tubes, reservoir or chamber proceeding from or connected with a compressing pump."

Q. Now, you have referred to the pressure on carbonic acid, which is, I believe, one refrigerant named by the patentee. Does he also name other refrigerants?

A. In this?

Q. The Lowe patent?

A. Yes, he does.

Q. What are they?

A. The specification at the end of the second paragraph of page 1 reads, "Carbonic acid, sulfurous acid, nitrous oxide, and some hydro-carbon gases are examples of the bodies which ordinarily exist in the gaseous state and which, by mechanical compression, are converted into a liquid state, as stated above, and it is such that I have employed in my process, preferring, however, carbonic acid."

Q. Now, as a mechanical engineer, do you know whether any such pressure would be used if he used the sulfurous acid, as he calls it?

A. Any what pressure?

Q. Any 600 pounds?

A. No, it would not be necessary.

Q. About what do you think it would be necessary for him to use?

A. Oh, the pressure on the high side runs from 65 to 90 pounds to the square inch.

Patent No. 716091 issued to C. C. Palmer Dec. 16, 1902, covered air-cooled system for refrigerator car.

Q. There is one other patent that I would like you to refer to in connection with a thorough understanding of the Wolf patent in suit. That is a patent to C. C. Palmer, number 716091, which was patented in December of 1902. I would ask you, in connection with that patent, if you find an air cooled condenser over which a blast of cool air is circulated by a fan?

Mr. Cooper: This is all subject to my objection if your Honor please.

The Court: Yes, it is. Is this patent included in your application?

Mr. Frye: This one happens to be, yes, your Honor.

The Witness: There are a number of Palmer patents, and I wish to refresh my recollection.

The Court: Yes, take your time.

Q. Take your time.

The Court: In fact, we will take a very short recess right at this point. You can look that over at recess.

(Recess.)

A. This patent, number 716091, to which my attention has been drawn, issued December 16, 1902, for auxiliary power device for cars. The drawings show longitudinal section of one end of a freight car, and a transverse section through a compartment which is located at one end of the freight car for holding refrigerating machinery. The main body of the car is shown only fragmentarily at the left hand side of figure 1. This is the refrigerating compartment. There is in this drawing a chamber in which there are located pipes (b) of a condenser (B) and below this chamber there is a fan (C) that was called a circulating fan, that receives its air from a funnel (K), which opens out into the air above the freight car, and the air is conducted down through a partition between the refrigerating coils, that is the coils in which the cooling fluid expands, and the machinery compartment. This air is blown by the fan upward over the tube (b).

The Court: That is the expansion tubes?

The Witness: The condensing tubes.

The Court: Condensing tubes?

The Witness: Yes, sir.

A. (Contiued): It is to be noted that the air that is handled by the fan passes through a hollow partition that is exposed to the refrigerating coils, so that the air is cooled before it passes over the condenser coils. The specification says nothing about that; in fact, all it says as to the fan is on page 1, commencing with line 96: "The fan (C) is used for causing a circulation of air over the pipes (b), from the condenser, so as to cool the refrigerating liquid after it has passed through the pump."

"From the chamber of this fan or any other suitable point a branch pipe leads to the chamber (d) so that a small portion of the air delivered by said fan is discharged into the chamber (d), or at least a sufficient amount is discharged into said chamber to maintain thereof a slight upward pressure sufficient to prevent the entrance of dust."

This fan has another function of making a pressure of air within the machinery compartment to prevent the entrance of dust, to exclude dust.

Q. Do you find the mention of any particular refrigerant in the Palmer patent?

A. No, I don't see any mention, and I don't recall that there is any in this patent.

Q. You have called attention in your first answer to the escaping of air into the outer compartment, so to speak; that is, the one where the condenser coils are not, but the compressor is. Now I would like to call your attention to lines 26 and 27 of page 2 and see whether or not you believe the statement there made would be tantamount to saying a circulation of air upon the compressor?

A. No, I think that such is not intended, I think it is intended merely to maintain a plus pressure within the machinery compartment to keep the dust out. Of course if there was any great leakage of air from the compartment there would be a circulation about the compressor that would tend to cool it.

The Court: What lines are those in?

Mr. Frye: 25 and 26 on page 2.

Q. Now is it your understanding, Mr. Witness, that the fan (C) is continuously rotating while the car is moving?

A. I think that is the fact. I have not read the description with reference to the belt, small (E), it is very meager, it appears to be a permanently belted connection to the shaft, large (C), on which the fan (c) is mounted. I think the fan is operating whenever the car is moving, and of course none of the machinery is operating unless the car is moving.

Q. Now we would like you to turn to the Kramer patent in suit.

Mr. Frye: I will say before we do that, that I would like to offer the patent—

Mr. Cooper: You can consider them marked for identification.

Mr. Frye: Yes, we want them marked.

Mr. Cooper: Why don't you wait and put them all in at once. Nobody will dispute they are the patents you called to the witness' attention.

Court record of exhibits:
No. 13 Frigidaire condenser.
No. 14 Pictet patent.
No. 15 Palmer patent.
Discussion of the Kramer patent.

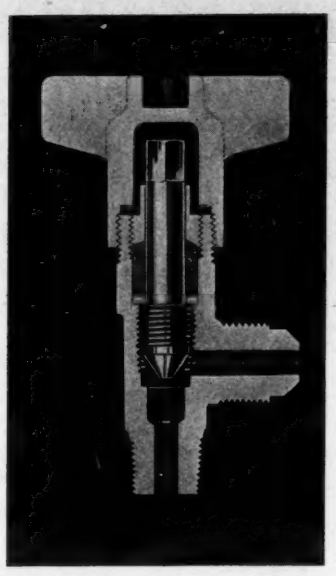
The Court: What is the number of the Pictet patent?

Mr. Frye: 14. Their new condenser offered this morning, is exhibit 13. I will have the Pictet patent marked "Exhibit 14" and the Palmer patent "Exhibit 15."

Q. Referring now to the Kramer patent in suit we would ask you to point out what parts are intended by the patentee to be movable from its normal position within the compartment below the refrigerator box, as by sliding it forwardly.

A. The compressor marked "8," the mo-

(Continued on page 22)



(Illustration-Type 235 Valve)

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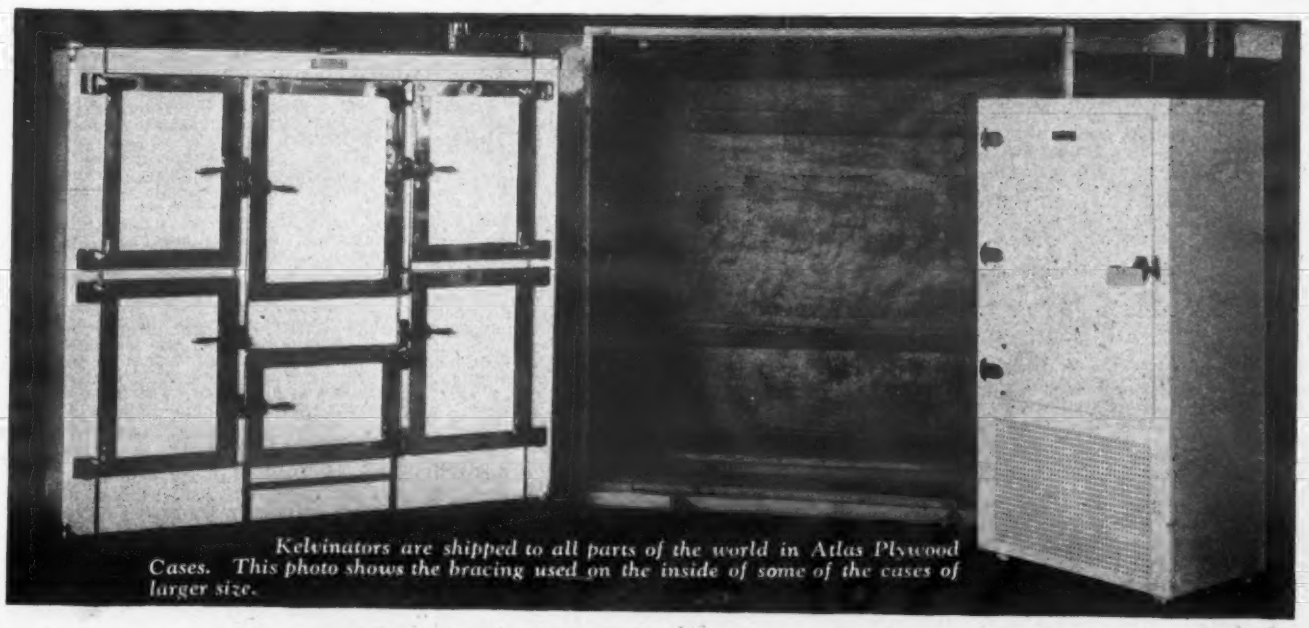

Kelvinators are shipped to all parts of the world in Atlas Plywood Cases. This photo shows the bracing used on the inside of some of the cases of larger size.

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Seven Factories in New England, the South and Canada. Branch Factories in Twelve Cities.

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Examination of Witness on Construction Shown in Kramer Patent

tor that is marked "29" which is shown directly connected to the compressor, the condenser which is marked "20," and there is in these drawings a specification, an oil filter placed between the condenser and the compressor, that was the part marked "10" and the pipe and the connections between the condenser and the compressor.

Mr. Cooper: Also the fan, 32.

The Witness: And the fan, 32; yes, sir.

Q. Are all of these parts located on a movable base?

A. Yes.

Q. And is it the base that moves and carries all of these several elements you have referred to?

A. Yes.

Q. Will you put in the record the numeral that designates the base that you refer to, just as you have with the other elements?

A. That part 78 is the numeral that is applied to the base.

Q. Now is there or is there not shown in this patent another base that carries all of the parts you have mentioned with the exception of the condenser?

A. There is a bed plate which supports the motor and the compressor, that may be called a base.

Q. Why do you limit it to the motor and compressor?

A. Well they are the fan and the parts that are—part 21 appears to be supported from this bed plate.

The Court: That is a filter there, isn't it?

Mr. Frye: The lower extremity of 10 is on the secondary plate.

The Court: What is the number?

Mr. Frye: 10; 10 and 21 on the upper base we think are bed plates. If not, we would like it pointed out.

The Court: I don't believe I am looking at the right picture. I am looking at figure 1.

Mr. Frye: Look at the next page, figure 7, I think it is much clearer.

The Court: What do you call the upper base?

The Witness: There is a part marked "78" that carries everything, including the condenser, then there is another part that carries everything except the condenser that has no numeral that I know of, he has termed it a bed plate. I think by reference to figure 5 you will see that 10 is located very close to the compressor and therefore must be carried by this upper base or bed plate. As I read the drawings, your Honor, the filter pan is supported by the tubes that connect it to the other apparatus. There is no other connection, and naturally it would be supported, I believe, by the bed plate or base that is most accessible for supporting it.

Q. Now, as a mechanical engineer, do you know whether it was new at the date of the filing of the Kramer patent, to assemble all the several parts you have mentioned on the single base?

Mr. Cooper: That, your Honor, is subject to my objection made in respect to the other patents.

The Court: It is subject to your objection.

The Witness: I am confused as to the meaning of your question. Do you refer to the refrigerator art or to what art do you refer?

Q. Let us restrict it to the refrigerator art, and the date of filing is February, 1915. Now do you know whether it was new at that time to assemble all of these several elements on a base plate?

A. In this particular location it was.

Q. How about any other locations?

A. Well, I don't know of any arrangement or any construction of apparatus embodying the motor, compressor and condenser that are all mounted upon one base.

Q. You are certainly familiar with the Wolf patent in suit, aren't you?

A. Yes.

Q. Will you turn back to the drawing of that a minute and say what parts are mounted there?

A. The condenser is mounted directly at the top of the refrigerator, the motor, compressor and fan are mounted on a common bed plate, which, in turn, is mounted on the refrigerator.

Q. Do you consider there is a direct parallel between the Kramer arrangement where everything except the condenser is mounted on a bed plate, as you have called it, and the showing in the Wolf patent, where everything except the condenser is mounted on a bed plate?

A. Will you explain the meaning of the word "Parallel" in your question?

Q. "Parallel" in that instance means that they have the same arrangements for accomplishing the same results.

A. My answer is "No."

Q. Well, that is not shown in the Wolf patent; that is not shown in the Kramer patent as regards—

The Court: That is shown—

Q. (Continuing) I say, what is missing? He says they are not parallel, they do not do the same things in the same way.

A. Can I hear the question again?

Q. I will put it in another question so there will be no misunderstanding about it. You stated that the Wolf showing is not parallel with the Kramer showing in the manner that I pointed out. Now what I desire to know by this question is what elements are omitted in the Wolf showing that lead you to that answer?

Mr. Cooper: I submit that calls for an explanation and comparison. I think the witness should be allowed to do that.

Mr. Frye: That is exactly what we would like him to do.

Mr. Cooper: Why not ask him to compare the two, it is a much simpler form of speech.

Comparison of arrangement of parts in the Wolf and Kramer patents.

The Witness: The Wolf patent, 1337175, has its motor, compressor and condenser mounted upon the top of the refrigerator in the exposed position where it is accessible, all parts of it are accessible for inspection and repairs. The apparatus is not assembled upon a common bed plate for sliding in and out of the compartment as it is already not in a compartment, and is as accessible as it would be if it were removed from a compartment. In the Kramer patent, 1280765, the motor, compressor and condenser, fan, and the oil filter, and connections between these parts of apparatus, are mounted upon a common base or support, which is supported by the slides underneath the food compartment. This makes it necessary to remove from this space beneath the food compartment the machinery that is to be inspected in certain parts or repaired. It permits the food box to be placed at the top of the refrigerator where it is most accessible to the housewife, and is a very different arrangement of refrigerator and machinery from that shown in the Wolf patent in suit.

Q. Do you consider the condenser, motor and compressor of the Wolf patent, mounted on the same plate?

A. They are mounted on top of the refrigerator, if that is what you mean, but they are not mounted upon a base that is of the kind and sort described in the Kramer patent, if that is what you mean.

Q. Perhaps we can express it this way: Do you consider the arrangement of the several elements in the Kramer patent, or is it the movability of such elements, when so arranged, that is the essential part of the Kramer patent?

A. They both are essential.

Method of disconnecting tubes so as to avoid loss of refrigerant explained.

Q. Does Kramer point out any way for disconnecting his refrigerator coil from the remainder of his apparatus when he desires to slide the base 78 away from its normal position under the box?

A. He shows the disconnecting couplings or unions 27 and 28 for disconnecting the pipe or the tubes that lead from the condenser and compressor to the refrigerating coil.

Q. Would you, as a mechanical engineer, say that they are the usual pipe couplings of copper tubing?

A. They are described in the specifications on page 2, commencing with line 82. It is a coupling that is used with copper tubing, yes.

Q. You started to say that it was described in a certain way. Will you put in the record just what you wanted to use for describing it?

A. I did not wish to encumber the record with this part of the specification. I will read the paragraph in if you desire.

Q. Well, we don't need a paragraph. Will you state whether you find the statement that the joint is formed like the ordinary union?

Mr. Cooper: I will admit that. It is found at line 83, page 2.

The Court: All right, that is enough.

Q. Now, as a mechanical engineer, do you know of any valve arrangement included in the ordinary unions of copper tubing? I am speaking now of copper tubing such as would be familiar to mechanical engineers and mechanics generally, in February of 1915?

A. So far as I recall, valve arrangements are separate devices from the unions. They may be combined in some special cases, but I don't know of—yes, I do, in certain carburetic connections I have seen union and valve arrangements combined in one structure.

Q. Would you call those ordinary unions?

A. They are special.

Q. Now, would you tell us what would become of the refrigerant should you disconnect the unions 27 and 28 in the manner shown in the Kramer patent?

A. If no provision were made for closing the pipe, the refrigerant would escape into the air, but the common practice of closing such pipes is by squeezing them together to make the gas tight joint, and then opening the unions.

Q. You think that was common practice in 1915?

A. I don't know how far back it has gone, but I recall such a practice in connection with gasoline automobiles as far back as 1909.

Q. When do you squeeze these pipes, before you disconnect them or afterwards?

Mr. Cooper: He has already said when, if you will listen to the record.

A. You squeeze them before you disconnect them and you squeeze them after you disconnect them; you squeeze them to close them before you disconnect them and you squeeze them to open them again after they are re-connected.

Q. Have you ever done that personally?

A. I have done it on the tube; I have not done it in a machine that is charged. I have a piece of tubing here that was so compressed and opened.

Q. You personally have done it in automobile work, but not in refrigeration work; is that the answer?

A. I have done it with a piece of copper tube here within the last few months. I have a piece of copper tube which has been treated in that way, ⅜ inch tube, that I squeezed and opened again.

Q. It was in refrigeration work, wasn't it?

A. Yes, it was in refrigeration work.

Q. Did you find there was any air admitted during such process of squeezing and opening?

A. This sample that I have here of tube was not connected as I stated to you. It was not in a machine, this tube.

Q. I did not get that.

A. No air can be admitted if the tube is not fractured.

Q. You heard the talk yesterday about constructions of tubes that would deter slugs of oil in passage. Do you suppose this squeezing and opening would deter the slugs after you had returned this connection?

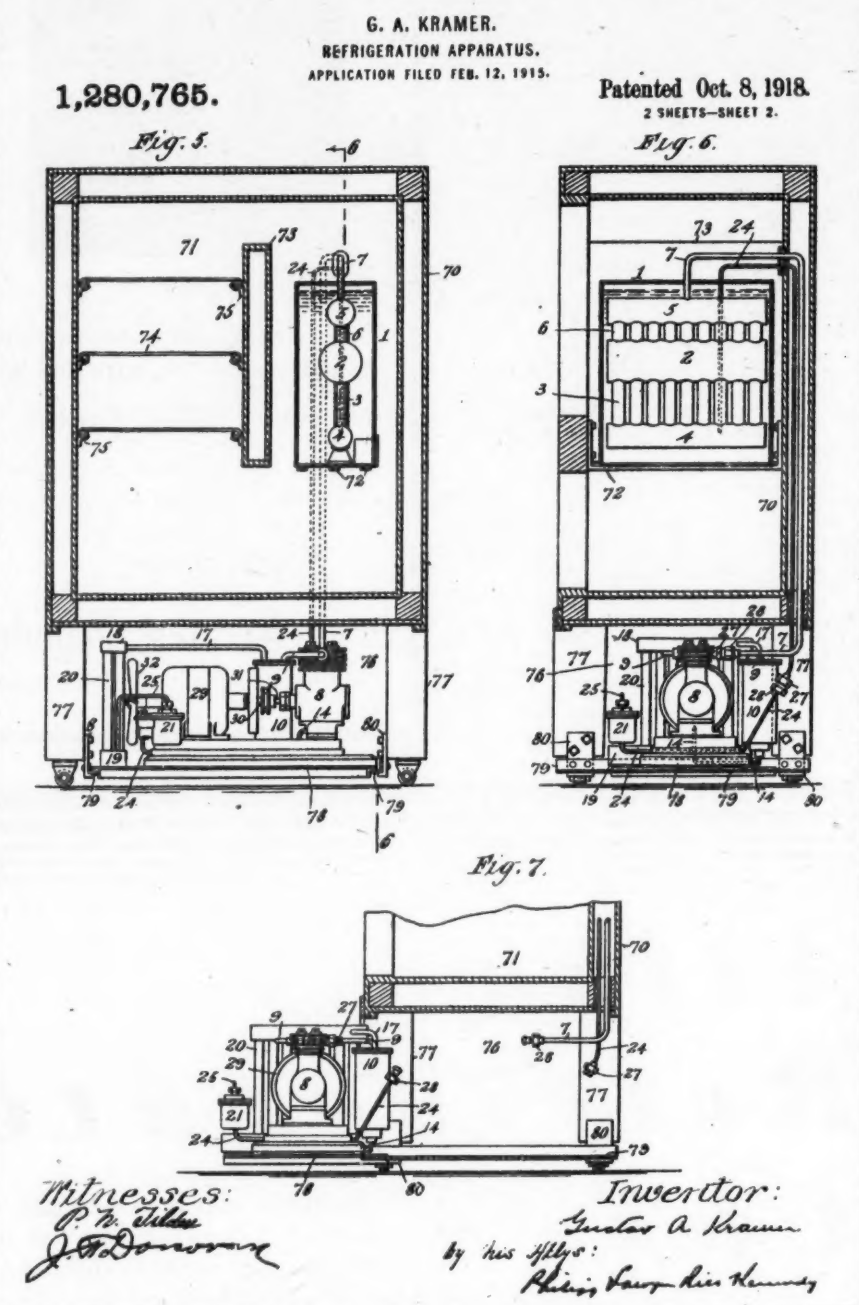
A. I never heard that it did. The tube is restored to practically its original cross section, in roundness,

Q. Well now, let's move over to the defendant's machine, Plaintiff's exhibit number 7, I think.

The Court: I think that is a good place to quit.

(Whereupon a recess was taken to 1:45 o'clock p. m., same day, Tuesday, March 19, 1929.)

DIAGRAMS FROM THE KRAMER PATENT WHICH WAS WITHDRAWN FROM THE SUIT BY FRIGIDAIRE



One of the two sheets of diagrams from Patent No. 1,280,765 secured by G. A. Kramer Oct. 8, 1918, and now owned by the Frigidaire Corp. Charge of infringement on this patent was withdrawn during the trial.

Q. Directing your attention to the defendant's machine, Plaintiff's exhibit No. 7, we would ask you to point out what part corresponds to the part marked 78 in the Kramer patent, which is the base that slides, if I remember your testimony?

A. It is the wooden base upon which the motor, compressor and the condenser are mounted.

Q. What part corresponds to the base shown above, the slidable base of the Kramer patent on which the compressor and motor of the Kramer patent are mounted?

A. There is no such part, the motor being mounted directly upon the wooden base, and the compressor and condenser being also mounted upon that base. I call attention to the fact that this compressor is a belt driven compressor and so there is no necessity for accurate alignment of the shaft of the compressor and the motor. In the Kramer patent there is shown a direct connected motor and compressor, there being no belt, merely one shaft coupled to the other, the shaft of the motor coupled direct to that of the compressor, and in such instance it is a common practice to provide a common bed plate upon which the motor and compressor may be mounted in order that they may accurately align with the shaft, may be held in accurate alignment.

The Court: In the same figure 5 of the Kramer patent will you point to the base concerning which you were asked and said was not present there—or I mean in the defendant's machine.

A. The part I referred to is not given a numeral, it is the part above the base 78, the portions between the base 78 and the compressor and the motor; that is, the base 78 is the foot plate of the support of the motor and compressor.

Mr. Cooper: May I ask a question there. Assuming that in the Kramer patent 78 and the parts immediately above it, which you say are not referred to by an identifying numeral, assuming that they were all made of a block of wood, could not that be just a series of stepped up portions of the same plate?

A. Yes, either wood or metal.

The Court: In figure 5 of the Kramer patent, Is there a bottom to the refrigerator structure proper below 78?

The Witness: There are slides upon which the edges of the plate 78 rests and slides.

Mr. Cooper: They are marked 79-80.

The Witness: The slide is marked 79.

The Court: They are the bottom then to the refrigerator upon which 78 rests.

The Witness: Yes—I don't know that there is a complete bottom, but there are slides, and then this place may make up the bottom instead of being a separate bottom.

Q. Now look at 79 and 80, how far from the side wall do they extend in the Kramer patent?

A. The parts 79-80—part 79 is described on page 5, line 98 of the specification as being angle irons supported by the brackets 80, 80 being secured to the legs of the refrigerator, and the angle iron, 79, which forms the slides, being held on the brackets, 80.

Q. To your knowledge as a mechanical engineer, about how wide would an angle iron supporting the slide of the base be in a refrigerating machine of this size?

A. An inch or two inches wide, or—well, that would depend upon the load it was supposed to carry, and I should suppose an inch and a quarter angle would support the load.

Q. Would the distance between those two angle irons be open below the plate, 78, of the Kramer patent?

A. In the Kramer patent I believe it is open excepting for probably cross pieces across the front and back, that would be flush with the angle.

The Court: In other words 78, you think, really forms the bottom?

The Witness: Yes, I think 78, which has the sliding base, also forms the bottom.

Q. Now, do you know how the wooden floor of the defendant's machine, exhibit 7, is secured to the machine proper, the box proper?

A. It appears to be secured by means of screws.

Q. Now, which screws are you referring to? Are they visible from the front of the machine?

A. I take it that these screws, that are in the corner of the plate are the screws.

Q. How can they secure that wooden floor to the sides of the box?

A. I will have to investigate to see just how they go. I have not made note of how they are secured, but it is obvious that any kind of a lag screw or bolt could be used to secure the motor support to the bottom of the refrigerator.

Q. Do you call the motor support the floor of that machine, exhibit 7?

A. The floor corresponds to the slides 79 of the Kramer patent. It extends clear across the bottom, whereas the slides 79 of the Kramer patent are merely angles at the sides.

Q. Now, please answer the question. Repeat the exact question, please, Mr. Stenographer.

(Question repeated by the reporter.)

A. The floor certainly supports the machine through the sliding base, the common base plate upon which the motor, compressor and condenser are mounted. Each is a support for the motor. One is a sliding support, the other is a fixed support.

Q. Now, do you know how, in ordinary practice, a machine of this type would be assembled and installed into the box of exhibit 7?

A. I have never seen a machine of defendant's manufacture assembled and installed in the box.

Mr. Cooper: You mean you have never seen the operation of installing?

The Witness: Never have seen the operation of installing such an apparatus: but it would appear to be obvious that the parts would be first—that is, the motor, the compressor and the condenser would be first mounted upon the wooden base plates, and then the wooden base plate with the motor, compressor and condenser, would be slid into place in the refrigerator.

Q. And that is your understanding of how this exhibit 7 was assembled?

A. I have no knowledge of how it was assembled, but that is an obvious way in which it could be assembled.

Q. Is it the way you had in mind when you told his Honor on direct examination that this had the elements of the Kramer patent?

A. I think so. It was one way.

Q. Now, will you examine and see how the board that is painted white on its forward edge is secured to the sides of the box in exhibit 7.

A. It appears to be permanently built into the frame of the box.

Q. At least, it is secured by elements not easily gotten out, isn't that true?

A. Yes, that floor is a permanent fixture of the box, as I understand it, in the same way that the slides 79 of the Kramer patent are a permanent portion of the box.

Q. Now, how is the bed plate carrying the compressor and motor, the question is of this assembly, it is not a question of ordinary or extraordinary?

A. I should say that would be the ordinary way of assembling the bolts so that they can be completely withdrawn from their holes and not be in the way to obstruct the sliding out or in of the machinery.

Q. Will you look at your chart, plaintiff's exhibit 10, and see whether they are arranged in the chart in what you have just described as an ordinary way?

A No, in this chart the nuts are on top.

Q Do you think that chart was made from this particular exhibit before these particular bolts were put back into place?

Mr. Cooper: I will object to that.

The Court: The objection is overruled.

A I don't know whether the bolts were in one condition or the other when the chart was made.

Q Did you ever remove the bolts from the bed plate of the motor support in plaintiff's exhibit 7?

A No.

Q Well, when this machine was referred to yesterday by you on direct examination, were there any bolts in those locations?

A I do not know. I assume that there were, but I did not notice it, and I cannot tell whether they were or not.

Q Well now, will you demonstrate to his Honor what has to be done before you can slide, in exhibit 7, the bed plate forward for repair or service?

A The four bolts at the corners of the base that secure the sliding base to the floor of the box, are first removed, and if the base with the motor, compressor and condenser does not have to be entirely withdrawn the assembled equipment on this base may be withdrawn with the base a certain distance by bending of the connecting pipes, which run from the compressor and condenser to the refrigerating coil in the food chamber. If the unit comprising the motor, compressor and condenser has to be completely removed, as for instance in effecting a complete change of units, then the shut off valves of the two pipes would be closed, first shutting off the liquid pipe and operating the machine until all of the refrigerant was withdrawn into the compressor and condenser, and then disconnecting the tubes or pipes and removing the entire unit.

Q Well now, are the four corner bolts that you have referred to easy to get at for removal?

A They are not very difficult of access.

Q If they were inserted from the bottom with a nut on top, and you removed the unit, then what has to be done before you can slide the bed plate?

A There would have to be space enough below the box to permit the bolt to drop down clear of the lower part of the base.

Q And do you think there is space enough in exhibit 7?

Mr. Cooper: I think that would depend somewhat on whether there was a depression in the floor underneath.

Mr. Frye: We are talking of ordinary and everyday—

Mr. Cooper: Oh no, we were not. We were asking a question, and I say that the answer to the question depends on that circumstance, in part at least.

A There appears to be not sufficient room to permit the bolt to drop through in the construction that is here in this exhibit 7. If the bolts were put in the other way, with the nuts on the bottom, they could be lifted out.

Q Do you know who put the casters on exhibit 7?

A I do not.

Q Do you think the machine was offered for sale with the casters on it?

A I know nothing of it.

Q. Now, examine the flywheel of the compressor and see whether that extends down below the floor and through a hole in the floor that is painted white on its forward edge?

A It does not. Considerable clearance above the line of the floor. I notice there is quite an opening in the floor, which I had not observed before, or had forgotten. Underneath this base, the floor is somewhat skeletonized, there being a considerable opening in the white floor.

Q Would that change your answers in any way, Mr. Witness?

A No.

Mr. Cooper: It might change your question where you refer to it as a solid floor, though.

Mr. Frye: I don't think I referred to it as a solid floor.

Mr. Cooper: I think you did.

A It has a clear space above the white floor, and the bottom of the flywheel, so that the floor would not interfere with the removal of the flywheel with the base sliding upon the floor.

Q How long would the operation you have described take to put all the refrigerant into the compressor and condenser in order to enable the shut off valves to be closed, how long would the operation take?

A I don't know, I think probably somewhere from two to four hours.

Q Then what becomes of the ends of the pipes that are opened by the uncoupling of the unions; do you admit air freely into those pipes?

A Yes, from the—if that was the method of disconnecting.

Q Isn't it the method of disconnecting?

A Yes, sir.

Q Now do you think the admission of air in there is a harmful thing to the machine?

A It would be if the air remained in there after the machine was again put into service.

Q What would be necessary to be done in order to again put the machine into service after you have removed something, that you have removed the base for?

AFTERNOON SESSION

Tuesday, March 19, 1929,
2:00 o'clock p. m.

Court convened pursuant to recess.

Frank L. Sessions was thereupon recalled as a witness on behalf of the Plaintiff, and having been previously duly sworn, testified further as follows:

Cross Examination (Continued)

By Mr. Frye:

Defendant's machine compared with the Kramer patent.

Method of Mounting Parts in Defendant's Refrigerator Discussed

A. Recouple, remove the air by known methods.

Q. How, for example, can you use the mechanism of this machine for it?

A. In certain instances, by leaving the coupling loose and admitting the gas, the gas will drive out the air. If the refrigerator coils are full of air it may be exhausted by means of an air pump before the couplings are made to reconnect the circulating circuit.

Q. Do you suppose any deleterious moisture would enter the refrigerator coil along with the air?

A. It might, but it would come out with the exhausting by the vacuum pump.

Q. How long would you have to operate the vacuum pump after you had completed the service?

A. I think—until you had created a zero pressure, that is—

Q. Do you know how long it would take approximately in this machine?

A. No, I do not.

Q. Would you say an hour or two hours?

A. It would depend on the size of the pump, I should think an hour would be ample.

Q. Now, as I understand it, the operation, in order to get ready for removing the base, would require from two to four hours, and the operation after you had returned the base would require anywhere from an hour to an hour and a half.

A. That is, if you are going to leave the refrigerant in the apparatus; if you are going to exhaust it, you could provide a container for the refrigerant and attach a connection to it, to this point, and pump all the refrigerant out of the system.

Q. How long would that take?

A. I think it would take about four hours.

Q. And how long to return it?

A. Several hours. I don't know how long.

Q. Now will you examine how that compressor is mounted on to the bed plate?

A. It is mounted by the means of through bolts passing through the base, the sliding base.

Q. They are just as easily removable as the bolts you have talked about in connection with the corner of the bed plate?

A. Yes, sir.

Q. Now, look at the motor; how is that secured to the bed plate?

A. In the same manner, by through bolts passing through the sliding base.

Q. If you were an engineer or mechanic and something was wrong with the motor, what would you do to repair the motor?

Mr. Cooper: I will object to that as indefinite; you will have to tell him what was wrong with the motor before you ask him.

Mr. Frye: Well, I presume he does not know and wants to take it out to find out.

The Witness: The motor might be disconnected from the supporting base, the sliding base, and taken off separately, or if I did not know what was wrong with the motor, I might suspect something else was wrong. I would take the whole sliding base with the motor out, as previously described, that is, take the motor and condenser out.

Q. After you had taken the motor, compressor and condenser out once and you had another call for the motor, what would you do, speaking as a mechanic or engineer?

A. I don't understand the question.

Q. Well, the second time you had to service the motor after the first time you have taken the four hours for the removal of the refrigerant, what would be the step you would take to examine the motor and see what is wrong with it, if anything?

A. The same thing as I did before, exactly.

Q. How long do you think it would take to remove the motor from the bed plate and disconnect the electrical connections?

A. Probably a half-hour.

Q. Would that in any way interfere with the operation of the machine as a refrigerating machine?

A. Your question is very broad, and, of course, it could not operate without the motor.

Q. Why not?

A. Nothing to drive it.

Q. What portion of the 24-hour day does the motor operate in the ordinary machine for household purposes?

A. 25 to 33 1-3 per cent, depending on the temperature of the room; it might run up to 50 per cent. In cycles of comparatively a few minutes.

Q. You mean the motor is running every few minutes, is that what I understand?

A. It cycles—the motor runs we will say from 15 minutes to an hour apart, the motor will operate until the temperature is reduced to again shut it off.

Q. And which machine is it, of exhibits 7 and 8, that operates at intervals of only 15 minutes?

A. I don't know which operates at such intervals, but I have seen machines operate at that frequency.

Q. Well now, what does the average, if you know, of the ones that are in operation today; are they coming on and off every fifteen minutes, or is there an interval of two to four hours?

A. In some services there would be an interval of two to four hours, we will say and in other services, it is much more frequent.

Q. Now, do you find there was something the matter with the machine whereby it would not drive—what do you think would be the logical method of servicing the motor, removing the entire apparatus or removing the motor and subtituting another at the interval of say half to three-quarters of an hour, and I am asking you as a mechanical engineer?

A. If the trouble were with the motor I should say to remove the motor or such part of it as necessary to make repairs.

Q. Then take your motor back and examine it in your own repair shop?

A. Yes, if you had to remove the motor.

Q. What ordinarily gets out of order about a machine like exhibit 7 in every day use?

Mr. Cooper: I object to that as indefinite.

The Court: Objection overruled.

The Witness: I have never seen any machine of the make of this exhibit 7, and have not seen any failure of the apparatus that is supported from the sliding base. The motor is not indestructible, it might get out of order; the compressor is not indestructible, it might get out of order; the condenser may have something wrong with it. I don't know what is the greatest source of trouble in the defendant's machine.

Q. Do you know about the plaintiff's machine?

A. No, except as to the machine I have had in service since 1925.

Q. How many times have you had to call the service man on that one?

A. I have the machine serviced every year.

Q. You mean once a year?

A. Yes. I have had trouble from what was told me to be wet refrigerant, and the motor burned out, and something went wrong with the compressor, but my—

Q. All at one time, you mean?

A. All in one instance, yes. My machine is not mounted in the box, my machine is in the basement, in a self contained base; nothing but the refrigerating coil, and the ice trays in the food box.

Q. That is your entire experience with the service of this type of apparatus, is it?

A. Yes.

Q. Now, will you examine the plaintiff's machine—

The Court: Before you leave that, I want to inquire about one thing. You notice the little blocks between the base of the ice box proper that has been referred to there, and the base on which the so-called units—elements of the unit—when it slides out those blocks stay with the lower base of the ice box, or do they stay with the base on which the motor and compressor rest?

The Witness: I think that they are loose, your Honor—I don't know that they are fastened to the other one—they are made of cork apparently, probably for sound proofing.

The Court: They come out?

The Witness: Yes, I think so, because this one is displaced from square with the rest of the base, and this appears to be squared.

The Court: Then, if they come out—the flywheel would extend down enough, so it would not slide straight out, that is all I had in mind; so long as it was inquired about I thought I would bring out the exact situation whatever it is.

The Witness: That would be the case.

The Court: The flywheel seems to extend a little bit—about how much would you say below—

The Witness: I would say about half an inch.

The Court: Yes, that is about what it looked like to me, and the very fact that they let the bolts extend below indicates it is not a thing that is intended just to slide out but would have to be lifted up.

The Witness: It would have to be lifted up to clear the hole in the bottom of the—

Q. Do you know of any purpose for putting in the four bolts at the corner of the bed plates, other than the one you have given, to prevent it from sliding, or to facilitate its sliding after they are removed, and I am asking you as a mechanical engineer?

The Witness: May I hear the question again?

(Question read by the reporter.)

The Witness: I don't understand—the only purpose of the bolts that I know of is to keep the machine from evaporating and moving on the floor of the refrigerator when it is installed.

Q. Isn't this what is known as a portable machine, that is, exhibit 7?

A. Yes, I think so. It is not a water cooled machine, as all self-contained air machines are portable.

Q. Is the one in your house a portable machine?

A No, water cooled right from the basement up to the coil.

Q Is it comparatively easy to loosen the connections where are the pipe of the cooling coil and condenser and so forth, particularly when the machine is moved around by inexperienced hands?

A If they become loose?

Q The unions or connections of the pipes.

The Court: You mean bolted the way that is or if it was not bolted?

Mr. Frye: No, I am trying to bring out the purpose of these bolts, your Honor, of course.

Q The question is whether it is likely to happen if that was loose in there without—are the unions rather easily jarred loose?

A They are not, they are tightened up and the angle of the copper joint is such that they do not loosen themselves by any ordinary vibration without a wrench.

Q Suppose they were loosened enough to admit air, what would happen to the machine?

A The refrigerant would be—now, if the unions, you mean—

Q If they were loosened to admit air?

A The refrigerant would be evaporated into the atmosphere.

Q Suppose it was on the high side where the pressure was greatest of the atmosphere, and there was an opening that would admit air on the low side, what would happen?

A Suppose what was on the high side?

Q The opening that is loosened so that inside of the pipe you have a material under pressure greater than the atmosphere.

A That was not your complete question. There was something at the end that I did not understand.

(Question read by reporter.)

Q The first question was one that would admit air would have to be on the low side, you see, and reverse it and put it on the opposite side and the same opening would be what?

A I don't just understand the question, but if I may state my own understanding of the question, if an opening occurs on the high side the gas would be discharged into the atmosphere; if the opening was on the low side and the pressure was below the atmosphere air would be sucked into the low side, but if the pressure were above the atmosphere there would be refrigerant discharged from the low side also.

Q The low side, isn't it usually below atmosphere?

A Not necessarily. It may run from low to considerably above.

Q I thought you told us yesterday that it usually ran five pounds below atmosphere on the low side.

A That is when the machine is operating.

The Court: That means a partial vacuum?

The Witness: That is when the machine is operating. When the machine is stopped, that pressure goes up.

Q Well, one of two things would happen, then, according to the time—one of two things would happen: it would either admit air into the coil or it would exhaust the refrigerant?

A Yes.

Q Is the admission of the air into the coils a deleterious matter?

A Yes.

Q Does that cause what is known as the wet refrigerant that you have referred to?

A It does sometimes.

Q Now, in both cases, the refrigerator ceases to work as a refrigerator, doesn't it, until repaired?

A Most likely, it does.

Q Well, we will have to assume an extent. It may go for a day or two days or so, until it is all out, but I mean with a reasonably short time?

A Yes.

The Court: What would be repaired?

Q What would have to be done in order to recondition that machine?

A The refrigerant might be saved that was left in the system, but if it were all exhausted from the system, then the leak would have to be repaired and the system recharged with new refrigerant, air exhausted from the system before the refrigerant was put in. The normal procedure would be to take out the apparatus, the unit, and repair it, and put it back in.

Q There is no way of doing that without withdrawing the base from the box?

A It depends upon where the repairs have to be made and what the repairs are. If the repairs can be made without taking it out, the sensible thing to do would be to repair it in place.

Q What I wanted to bring out, are there provisions on the defendant's machine for recharging without removal from the floor?

A Yes, both for discharging and recharging. The connection can be made to remove the charge and put in a new one.

Q Now, would you not say that it is highly essential to successful operation of a machine of this type that it be mounted so that there will be as little as possible vibration of the parts?

A Yes, that, I think, is true of practically all machinery. It is an axiom in machine designing.

Q Particularly true if they are going to be portable, or moved by inexperienced persons?

A Well, in moving any machine, it is bound to be subject to vibrations. I cannot see why there should be any greater care used in the making of a portable machine than the making of a stationary machine.

Q Now, you yesterday referred to the separated coil of defendant's machine. Now, does plaintiff's machine in the exhibit before us, use substantially the same coil?

A What coil?

Q I am speaking of this separated refrigerator coil, exhibit 8.

A In plaintiff's machine the refrigerating coil is not enclosed in the brine tank, but is entirely open and exposed to the surrounding air. It has the same function of cooling the food box as defendant's.

Q Where is the expansion valve in the plaintiff's machine?

A At this point here (indicating), in front of the cooling—

Q The one that you touched with your finger, the uppermost of the horizontal pipes on the coils?

A Yes.

The Court: This (indicating)?

Mr. Frye: That one, yes—the expansion valve, he says.

Q Do you think there is a float inside of that refrigerator coil?

A Yes, in the tank at the top I think there is.

Q Does that admit liquid down into those pipes that extend around below the coil?

A Yes.

Q Then it would be liquid on the other side of the expansion valve in that particular job, wouldn't it?

A. Yes, sir, it would.

Q. Do you remember on your direct examination saying that after it passes the expansion valve it goes immediately into gas? If so, would you like to make any corrective statements?

A. The change from the liquid into the gas occurs—starts to occur—as the liquid leaves the expansion valve. It takes some time for it to change to the gaseous state completely.

Q Did you ever hear of a flooded system?

A Yes.

Q Do you think that plaintiff uses it in this particular exhibit ahead of us?

A. It is a flooded system so far as the control of the liquid level is concerned.

Q Well, isn't that what admits it to the refrigerator coil? In other words, there is liquid above or behind what you have called the expansion valve as liquid, and then, when that liquid is collected to a certain height, the float operates to admit liquid down into the refrigerator coil.

A Yes, that valve is an expansion valve.

Q Well now, what is the valve, if any, in the lower horizontal pipe in the exhibit before us?

A I find that I was wrong in stating that the top valve was the member that admitted the liquid to the drum at the top of the expansion coil. It is the small that admits the liquid to the drum, and the large pipe at the top takes the gas back to the compressor.

Q Does either of them have an expansion valve in, as you now see it?

A No, the valve is operated by the float in the receiver or tank.

Q What is the rather ornate part with yellow and gold on the bed plate of the lower portion of plaintiff's machine?

Operation of the thermostat.

A That is the controlling element, for controlling the temperature.

The Court: A thermostat?

The Witness: It is a thermostat or a pressure operated device, by means of a diaphragm motor, which responds to the pressure upon the suction side of the compressor. When that pressure becomes at a certain amount, the electric circuit is closed by this pressure operated motor that starts the main motor of the device into operation, to operate the machine.

Q Do you know how long Frigidaire has been putting that on their machines?

A I do not.

Q Has it been a few months or a few years?

Mr. Cooper: He says he does not know. I think that exhausts the subject.

Q Have you any knowledge of it?

A I don't know how long it has been used.

Q Will the machine work without the control element?

A If it is to be automatic, it must have some kind of a control element. It might operate with a temperature control or with a pressure control.

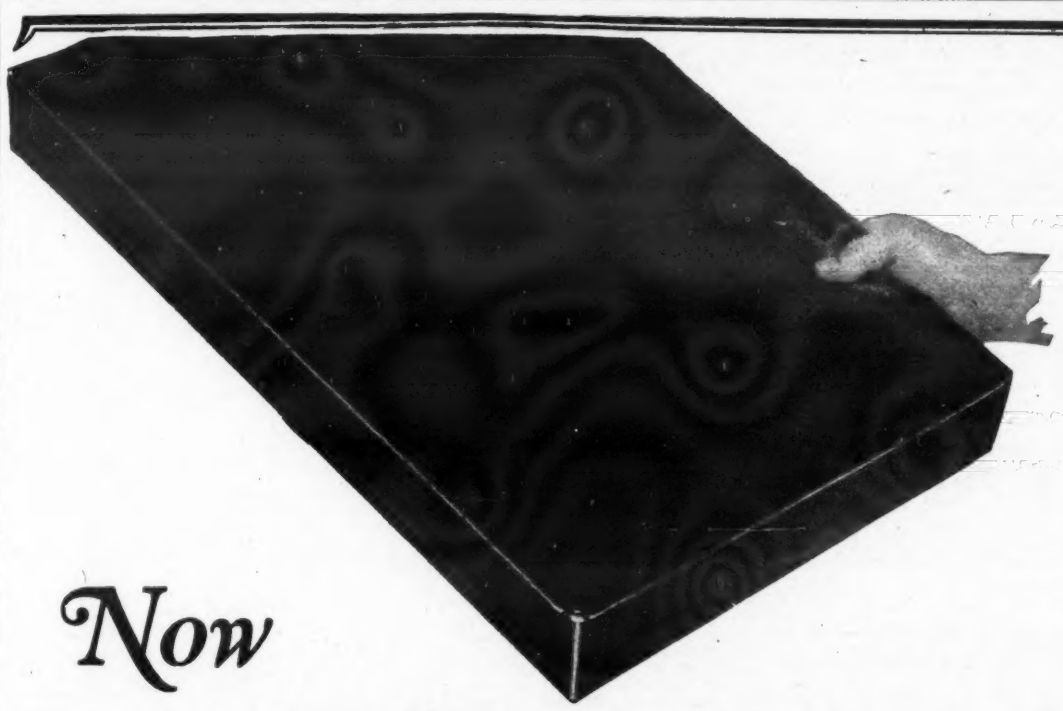
Q Well, let me ask the question this way. Do you think the exhibit 9 before us is a 1929 model Frigidaire?

A I do not know.

Q Well, do you think it was made at approximately the same year as the one that is exhibit 7, defendant's machine?

A I do not know.

(Continued on page 24)



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Validity of Wolf Patent Attacked by Counsel for Defendant

By the Court:

Q In exhibit 7, where is the automatic control?

The Witness: It is a thermo-couple; that is, screwed in this plate here, and there is a little cube that goes down to a device (indicating).

Q Well, is it a temperature control or a pressure control?

A It is a temperature control. That is, there is a liquid, a volatile liquid, in this device, that is screwed in here, that creates pressure responsive to temperature, that operates the switch to operate the motor.

Mr. Cooper: Is that all?

Mr. Frye: Yes, take the witness.

Mr. Cooper: I have a few questions to ask.

The Court: Do you want him here?

Mr. Cooper: No, I am not going to question him on this.

(The witness returned to the witness stand.)

Copper tubing unsuitable for use with ammonia.

Redirect Examination

By Mr. Cooper:

Q On cross examination, when you were being examined about the 10th claim of the Wolf patent, I understood you to say something to the effect—I am not able to locate it in the stenographer's minutes—but I understood you to say something to the effect that the apparatus of that claim might be used with any one of several refrigerant substitutes which were named, and one of which I think was ammonia. Have you anything to say about that, if you did so?

A My recollection is that the question that was asked me related to the element of the claim and I replied that ammonia could be used, but in consideration of the matter, I have thought of the limitation imposd by the disclaimer, which calls for copper tubing, and copper tubing is not suitable for use with ammonia. Copper is dissolved in ammonia, consequently ammonia could not be used as a refrigerant in that structure.

Q Your attention, when you were under examination by the defendant counsel, was called to three United States patents prior to the Wolf patent in suit, that is, to Lowe 63413, to Pictet 187413, and to Palmer 716491. I will ask you whether any of these patents contains the combination of any of the claims of the Wolf patent in suit?

A None of them contain such combinations.

Q Is there any other prior patent or publication which has been brought to your attention at any time which does contain the combination of any of the claims of the Wolf patent in suit?

A No.

Q When you were under cross examination about the Kramer patent in suit, your attention was called to the Wolf patent 1337175, and you were interrogated considerably about the relation of its disclosures to what you have described as being set forth and claimed in the Kramer patent in suit. I will ask you whether that Wolf patent in suit discloses a combination of the Kramer patent in suit?

A It does not.

Q Is there any other patent prior to Kramer's date, or any other publication known to you, which does disclose the Kramer combination as you have discussed it?

A There is not.

Mr. Cooper: That is all I have to ask.

Recross Examination

By Mr. Frye:

Q Are there any other refrigerants that you would like to withdraw from within the purview of the first element of claim 10?

A I think not, of those that you called to my attention.

Q Well, as a mechanical engineer with knowledge of refrigeration, you said yesterday that it was worded so that practically any refrigerant would fall within the terms, which are, "Compress a refrigerating gas to a pressure the corresponding boiling point of which is above the temperature of the atmosphere."

A I am inclined to think that carbonic acid or CO2, carbon dioxide, would have to be compressed to such pressures, that it would be unsafe to use in copper tubing 3-8 inch diameter with comparatively thin walls. That is the only refrigerant that occurs to me now, in addition to ammonia, that would be unfeasible to use.

Q Well now, suppose we tinned the surface of the copper tube; could you use ammonia with it?

Mr. Cooper: You mean tin the interior? Do you mean tinning the interior?

Mr. Frye: Whatever surfaces are necessary to be contacted by the ammonia?

A I think it would be a highly impractical proceeding. Whether it would operate for a time or not, I do not know.

Q Did you ever hear of condensers in refrigerating apparatuses having tinned inner peripheries on tubes?

A Yes.

Q Was that impractical?

A Those that I have heard of were very short tubes, relatively, and of somewhat large diameter. Its difficulty would be, in tinning the tube of a small diameter and length, and being sure that it was properly tinned throughout.

Q. Now, considering the first clause of claim 10 alone, that is the means to compress and so forth, do you think that it defines ammonia, carbonic acid and whatever other refrigerants you desire removed at this time?

Mr. Cooper: I don't think that is proper recross if your Honor please. I did not open up the subject generally. I simply asked him to correct his statement.

The Court: The objection is overruled.

The Witness: May I have the question, please?

(Question repeated by the reporter.)

A. I do not understand the question.

Q. Well, is ammonia a gas that can be compressed to a pressure that has a corresponding boiling point which is above the temperature of the atmosphere?

A. Yes.

Q. And has carbonic acid such properties?

A. Yes.

Q. Then as far as that clause is concerned, it is worded broadly enough to cover ammonia and carbonic acid, is it not?

A. Yes, as the clause stands.

Q. Now, you have made the statement that none of the three patents called to your attention on cross examination show the combinations which you have specified in connection with the Wolf patent. What element, if any, is missing in the three patents, taking them singly or collectively, as you like?

A. None of the three patents show or describe a household refrigerator for domestic purposes.

Q. Have you completed your answer?

A. No.

Q. Go ahead.

A. (Continued) None of them show and clearly describe an atmospherically cooled condenser for condensing a compressed gas. None of them show a fan mounted to effect circulation of air around an atmospherically cooled condenser.

None of them show the air cooled condenser made of considerable length of tubing having a comparatively small cross section and comparatively thin walls, or copper tubing of substantially ⅜ inch diameter or metal tubing of not over one half inch diameter.

Q. Have you completed your answer?

A. Yes.

Q. Do any of the claims of the Wolf patent in suit, call for a household refrigerator?

A. They do not call for it in words, but they call for a refrigerating apparatus, and the definition of the refrigerating apparatus as I read it from the specification is: One intended to be used for domestic purposes.

Q. Will you read the paragraph beginning at line 14 of page 1 of the Wolf patent? It is quite short.

Mr. Cooper: Well, that has already been read into the record, I think, a half dozen time. I rather object.

Mr. Frye: That particular one has not been read in the record.

Mr. Cooper: I beg your pardon. It was read in as part of your cross examination.

The Court: I will permit it as part of his cross examination.

A. The paragraph reads: "This invention relates to refrigeration, and particularly to processes and apparatus involving compression of the refrigerant as distinguished from absorption systems." That is the entire paragraph.

Q. Is that paragraph what, in ordinary consideration of patents, is viewed to determine the scope or subject matter of the patent?

A. No. not unless the entire specification is used to determine the scope of the claims.

Q. Suppose we made a refrigerator of precisely the size of the one in exhibit 7 and used it in a store. Would it be a household refrigerator or a commercial refrigerator?

A. It would be a household refrigerator.

Difference between a domestic and a commercial refrigerator.

Q. What determines a household refrigerator from a commercial refrigerator, so to speak?

A. The size and adaptability to the small user.

Q. Is it the number of pounds of ice every day in capacity?

A. That might be indirectly the measure of the term "Domestic purposes;" there is no reason why a refrigerator that was used for domestic purposes could not be used for commercial purposes, any more than an automobile used for pleasure could be used for business purposes; it is the same thing.

Q. We would like you to explain on the record what you have in mind when you say that the claims in suit on this patent are limited to household refrigerators; have you expressed it to your satisfaction?

A. Yes.

The Court: Is there anything in the specifications which say that?

The Witness: Page 1, commencing with line —, states definitely, "The invention is primarily intended to be used for domestic purposes." The apparatus that is shown and described as a small compact refrigerator, not any larger than the ordinary ice box refrigerator of the household.

Further consideration of Palmer patent.

Q. Now will you turn to the Palmer patent, to which your attention was called this morning? Does it show a compressor?

A. Yes.

Q. I believe you said this morning it does not describe what refrigerant is to be used therein, is that the fact?

Mr. Cooper: I will object to this rejurgitation of the old subject. He was fully examined about this on cross examination. That part was brought out, that the refrigerant was not mentioned. It is no use to have it started again.

Mr. Frye: We are taking, element by element, claim 10, Mr. Cooper. We have been trying to hurry it all we can.

The Court: If he has found any mention of it—

Mr. Cooper: Well there is none, we will take that and go on with something else.

Mr. Frye: All right.

Q. Now, is that an atmospherically cooled condenser for condensing compressed gas?

A. I don't know.

Q. Well, what do you understand the element (b) to be?

A. That is a condenser, it is a conventional showing of one view of a pipe, it is the only showing of the condenser that there is in this patent; this inventor has shown substantially the same types of apparatus in which he had the pipes closed with fibrous material and wet, and the air permitted to pass or be blown over them. I don't know what kind of a condenser this is.

Q. I call your attention to lines 98 and 99 of page 1 where is says: "So as to cool the refrigerating liquid after it is passed through the pump." Referring directly to the fan, (C), and the pipe, small (d). Can you explain the purpose of that little (b) element?

A. Yes, the little (b) element is the pipe in which the refrigerant is condensed, but whether the pipe is covered with fibrous material and wet cannot be told from this. The air is blown over the pipes, but if the pipes are spread or covered with wet fibrous material it is not air cooling—

The Court: What would be the purpose of that?

The Witness: To blow the air over?

The Court: Yes.

The Witness: To operate the water, to cool by evaporation of water, the addition of a complex system of cooling, complex features for cooling.

Q. Do you see in lines 96 and 97, the fan (C) is used for causing a circulation over the pipes, B, or do you understand over to be above or in contact with?

A. It may be either.

Q. What would you interpret it to be, as a mechanical engineer, with the showing of the drawing and description you have before you?

A. It would be to circulate the air about the pipes, (B), either for cooling by direct contact of the air with the pipes, or by cooling through the evaporation of the liquid in the covering of the pipes.

The Court: In other words, the word "Over" does not mean above, but it means on the surface?

The Witness: Yes, sir, around.

Q. Where, in the patent before you, do you see any mention of coverages for pipes, (b)?

A. There is none.

Q What other patent was it that you referred to that might have it in?

A In some other patents to Palmer, that were cited in the answer.

Q Was it filed before this one or later?

A I don't recall, I think they were before.

Q Well now, considering the question as to whether you find an atmospherically cooled condenser for condensing compressed gas in the Palmer patent, number 716091?

A It is air cooled in a measure, whether air is the only element used or not, I don't know. The air itself is cooled before it is passed by the fan over the coils, so that it is not atmospherically—it is not air of atmospherical temperature that is passed by the fan over the coils.

Q Taking the patent before you, within the confines of its four walls, and without importing something from other patents, what would your opinion be as a mechanical expert concerning whether little (b) is an air cooled or atmospherically cooled condenser. Please answer that question.

A It is not a condenser that is cooled by air of atmospheric temperature. The air that is passed around the condenser is brought in past the refrigerating coil, and some of it, if it is hot, goes to the refrigerating coils, so it is cooler than the normal atmosphere, and that makes a cooling means in addition to that of the temperature in which the apparatus is located.

Q Will you point out in the patent before you where it says the incoming air is cooled preparatory to being passed over the coil, little (b)?

A There is no description of that any more than there is a description of the condenser, but the drawing shows the passage leading from the funnel (K), extending directly down to the partition that separates the apparatus room from the refrigerating coil into the fan, the space which encloses the fan.

Q Is there or is there not a partition wall between the incoming air funnel and the cooling coils, large (L)?

A Yes, there is a wall there, and the passage from the funnel (K) extends down through that partition.

Q. Well, doesn't it pass on the opposite side of the partition from the cooling coil so there is an insulating wall between the cooling cails and the incoming air funnel?

A There is a wall there.

Q Do you understand how the fan. C-2, operates to draw air from around the cooling coil wall into the refrigerated portion of the car?

A That is a circulating fan for circulating air in the car, as I understand it.

Q Does it draw air up from the bottom towards the top, or does it send air down, if you can tell us?

A I cannot tell from the drawing, I will have to see if the specification says anything about it. The specification merely calls the fan, C-2, a circulating fan. It is found on page 1, line 57-8: there is nothing else said about that fan.

Q Well, passing on to the next element, claim 10 of the Wolf patent. Does that patent before show you an expansion chamber into which the liquid is expanded?

A It shows the refrigerating pipes through which the refrigerating fluid is passed. If the refrigerating apparatus be of the type with which we are concerned, that would be the expansion chamber.

Q The coils, large (L)?

A Yes.

Q. Now, are the parts connected from a closed circuit for the refrigerant, the parts referring back to the compressor, automatically cooled compressor and expansion chamber?

A. There is no detail of the refrigerating apparatus shown. This patent has to do primarily with the creation within the machinery compartment of a pressure by the fan, C, which keeps the dust from percolating through the crevices, that is, the air from the fan, see, is blown out, and the expectation is that dust will not enter as long as the dust is going out of the car into the air instead of coming in from the outside.

Q Would you call that the primary purpose of the patent before you?

A Judging from the claims it is.

Q Have you answered whether they are connected in a closed circuit?

A Presumably they are, but from the connections shown which are not described, it is impossible to determine.

The Court: It would have to be closed in order to be serviceable.

The Witness: Yes.

The Court: It could not work unless it was closed.

The Witness: No, I say presumably they are, but there is nothing in the patent to show or to tell it.

Q As a mechanical engineer you would give it as your opinion that they were connected in a closed circuit, would you not?

A Yes, and they are shown in a conventional way, because they are not regarded as important in this patent, from the beginning they have been enclosed in all types, the commercial type and the car types and every type.

Q. Yes, that is the A B C of refrigeration.

The Court: So, then, at that date it was not then even necessary to tell that to the world; it would not have done any good to tell that.

The Witness: No, that is correct.

Q Now, without taking this element by element, and analyzing the claims 15, 16 and 18, would you care to put on record whether there are any other conditions that you desire to feature between these claims 15, 16 and 18, over the Palmer patent than you have stated in connection with claim 10?

A Of course there is one vital difference, this Palmer patent is an apparatus that is driven by the car axle, there is no motor other than the friction of the wheels upon the rails to drive the refrigerating apparatus. When the car stops the refrigeration ceases. If the car is sidetracked for an hour or two, the food stuffs are likely to spoil. That, of course, takes it out of the household refrigerating class, as the household refrigerating apparatus must have a motor for driving.

The Court: Is that the present method of refrigerating cars, if you know?

The Witness: I understand there have been cars of that type built. I don't know of any now in use. The general method of refrigrating cars is to ice them by actual ice. Enormous icing plants at stated points throughout the country.

The Court: No machinery in them.

The Witness: No machinery in them.

Mr. Frye: That is all.

Mr. Cooper: That is all we have. That is our case, your Honor.

(The plaintiff here rested its case.)

(Intermission.)

Court welcomes further enlightenment on the principles of refrigeration.

Opening Statement on Behalf of Defendant

Mr. Frye: Now, if your Honor please, I would like to make a brief opening statement of the defenses about to be offered in this suit.

I believe you are familiar now with the construction, operation and so forth of the Wolf patent in suit. We also believe that you are familiar with the construction of the defendant's refrigerator, an example of which, exhibit 7, is in suit.

The Court: If some witness for you wants to go over the elementary principles of that, even though I think I understand them, I will be glad.

Mr. Frye: We will be glad to do that.

The Court: It was new to me when you began here, and there may be some things about it that I do not understand.

Mr. Frye: We have a series of enlarged drawings, just as the one on our right here, where the colors are used to make it a little easier to discern several elements. For example, the color red is used to illustrate condensing means, and that color is to be used uniformly throughout the several reference patents to which we will refer. The color yellow is meant to refer to an air space or chamber, where the air circulates. The color green is intended to show the cooling or refrigerator coils.

Now, when those first were made—

The Court: The green goes out beyond your coils.

Mr. Frye: Well, at times it does. Maybe the word "Coil" is bad. The refrigerating element, or the cooling element, which may be a tank or may be something other, but it is cooled by a coil which is distinguished from the coils used for condensing by the contrasting colors red and green.

Now, there are other elements that are uniformly colored throughout the several reference patents to be referred to, and these drawings happen to have been made, for the most part, when there were other patents in this suit that referred to certain elements.

For example, the purple refers to what is termed the expansion valve, the brown refers to what is known as the ice trays—that is, for making individual cubes of ice, and so on.

There is a color blue, used for showing a fan, and always an air circulating fan.

If there is a circulation of brine or something of that kind, it will be colored differently and the same way with a platform as distinguished from the box.

The Court: I thought the green was the brine?

Mr. Frye: The green is intended to be the cooling or refrigerating element, regardless of whether it is brine or another kind, but where there is brine shown particularly, we give it a contrasting color, so that it will be in evidence.

In that particular one, we just have the green so it will be evidence what is the element referred to.

Now, I have brought that up by way of example, so as to show the theory, and we will endeavor to make it clear to your Honor where certain elements are located in each of the reference patents referred to.

The Court: Well now, not all of the air is made yellow.

Mr. Frye: No, only where air is circulated, air chambers—for example, if we have an open chamber where there is nothing but air, like in a housing here, we have made that housing yellow; so that it will be clear where the element ends and the rest of the chamber begins.

Let me take one or two others, to make certain you understand.

The Court: In my opinion, there is lots of air up above there that is white.

Mr. Frye: Well, that is not air, that is useful for the purposes of this suit. We have still air that is inside of a refrigerator.

The Court: It is the air that is cooled, and that air in turn keeps the food cool?

Mr. Frye: Well, don't you see how confusing such a drawing would be? We have endeavored by the yellow merely to show where there is air, and by the others where there are certain elements to which we are going to refer. We have tried to keep it clear, and here is one where the yellow seems to be quite predominant.

The Court: That is some certain patent that you will refer to?

Mr. Frye: Yes, that we will refer to. And the fans are blue, the condensing element is red, and the cooling or refrigerating elements are green, while the surrounding air is yellow. That is, the space where the air travels, the air chamber.

The Court: Cooling air?

Mr. Frye: Sometimes it is cooling, other times it is taking the heat out of the condenser. It happens in this particular pipe, you will notice it runs beyond the rest, the air from the small fan, which is a separate one from the large one, is blown right by the condensing element in red and out, the patent saying that it goes to a flue or something of that sort.

Now, in the meatime, the remaining air that circulates around the green is cooled air and it is separated from the air around this particular condensing means by a cylindrical chamber, but that is not to be referred to specifically at this time except by way of reference.

The Court: Then that yellow is really giving off heat—

Mr. Frye: Well, in both cases the air takes the heat from the elements, either red or green.

The Court: Well, now, from the green above there it would be giving off heat to the green, wouldn't it?

Mr. Frye: You use the expansion of the refrigerant inside of the green cylinder to cool the outside air?

The Court: But I say, in the yellow it is giving off heat; in the yellow around the green, it is giving off heat, while the yellow around the red is taking on heat?

Mr. Frye: It does, yes, you are right in that respect; yes, your Honor, the red and green are for opposite purposes.

The Court: But the yellow is really moving air, as far as you can give any real definition to it?

Mr. Frye: Yes, it is the chamber in which the air moves, that is what we tried to color—the chamber or chambers of course.

The Court: Really for the transmission of heat, sometimes one direction and sometimes the other, isn't that it?

Mr. Frye: Yes.

The Court: I want to get so I understand it as it comes along; but I would take it that the yellow represents air which is used for the transmission of heat, sometimes for the purpose of cooling and sometimes for the purpose of heating. It is perhaps not fair to say for the purpose of heating, but it is for the purpose of being cooled, giving off heat so it can become cooler.

Mr. Frye: I think you are getting the idea of this, your Honor, but we will have an expert that will go into it again in case there are any questions that we would like to ask him.

Counsel for Defendant attacks validity of Wolf patent.

Now, as I say, our main defense in the Wolf patent is that is should never have been granted as a patent—that the disclosure does not rise to what we term the dignity of invention. It is invalid, in other words, because it has not sufficient disclosure over the prior art to warrant it being a patent.

Now, that is rather a broad statement, and when we refer next to the invalidity of the claims in issue, we will go specifically into the several elements of the claims in combination, and point them out in prior patents.

Now, there are a number of such prior patents. One of them is shown before you, the patent of Leslie; another one to which our attention has been called, the Palmer patent, and that has been colored and enlarged so as to make it rather clear as to which elements are which.

We contend, your Honor, that the disclosure there is sufficient for a man skilled in the refrigerating art, to which this appertains, to make the combination set up in the claims of the Wolf patent in issue.

Now, we do not believe that on argument is the time to bring out all of these several references, but we have a number of them in connection with railway cars, and also in connection with other types of refrigerating machines. For example, here is another one that was to be used in connection with the Kramer patent. It keeps bobbing up through the art, the improvements in refrigeration cars. We are rather surprised at the statement by the expert for plaintiff that the very fact that it was a car and operated from the car axle made it absolutely inoperative for the purposes of the present suit. We contend that the disclosure in a device of that kind is just as pertinent as a disclosure in a machine that is to be used in a butcher shop or elsewhere. The complete refrigerating apparatus is in the car, it is air cooled as far as the condensing means is concerned; and as far as the refrigerator coil is concerned, it cools air which is passed around the parts to be refrigerated, such as a food storage chamber.

The relative size of that chamber is, we believe, not the fundamental part for securing a patent. In other words, where it is merely a change in degree, you are refrigerating seven cubic feet area in place of 70, that that is not what patents are for; that we use the same general principles and the same general machinery.

The invalidity of the claims in suit because of prior uses of publications, of course including patents, is what we might term the main defense against the Wolf patent in suit.

We also, however, consider the entire Wolf patent invalid because of its file wrapper, which means, of course, the method by which it was obtained from the patent office. We believe that statements were made in the file wrapper that misled the Examiner or Board of Examiners into granting the claims of the party in suit, where if the exact facts are brought out, as we hope to do to your Honor, that the reason why any patent should have been granted will be eliminated.

First application of Wolf disallowed by Patent Examiner.

The Court: Was it first disallowed by the Examiner and then by the Board?

Mr. Frye: Then allowed before the Board.

Now the argument made by the attorney prosecuting the application was as to a specific combination of SO2 as a refrigerant, and air cooled condensers. We expect to prove that there is no such special advantage, and that the statement to that effect would never have been made by a skilled engineer or one qualified in refrigeration. We know from the file wrapper also that the inventor, Mr. Wolf, after he had sold the patent, refused to co-operate with the attorney who was making that argument; the attorney puts in an affidavit to that effect and obviates the requirements for a division of certain claims in the process, on the ground of this refusal to co-operate.

The Court: We have no process here, have we?

Mr. Frye: No, but in the patent they require a division, and the attorney stated he could not get the inventor to co-operate in signing a division or application. That is all in the file wrapper.

Now, the main idea is that the claims were allowed by a rather narrow squeak, so to speak, and the Examiner refused to allow them on the appeal because of an argument that we believe was prejudicial to the interests of the public; the Board of Examiners were prejudicially interested, or—put it this way, was prejudiced in the granting of these particular claims.

We understand that we have not the right to collaterally attack a patent for fraud, and we make no intent or attempt in this case for charging for it on the part of anybody, but we believe that it was understood on the part of the attorney, because he was not in close touch with the inventor, so he could take up the questions as they arose. Under these

First Application Disallowed

circumstances we believe he did the best he could.

The Court: All of the claims were disallowed, you say, in the patent?

Mr. Frye: Oh no, no. When this particular application was filed the claims were drawn to the structure of the air compressor, rather specific claims. There are none of them in suit. Three of them are cancelled and the original claims, four and five, are now in the case, but were not selected by the counsel for the other side. One action was taken by the patent office and claims 1, 2 and 3 were objected to because of a statement that the condensing coil is constructed to provide a maximum length of coil with a maximum of radiating surface, which we believe will give an inside as to what the inventor himself thought should have been claimed.

The Court: I don't understand what you mean by maximum length.

Mr. Frye: The examiner said he did not understand it either, your Honor, that is what the objection was. They argued the question back and forth, and they finally amended the claims by cancelling the three claims, and putting in place of them two claims which are now in the patents as claims 1 and 2, and they use different words, and as I say, they are rather specific claims.

With those two claims and the original claims 3 and 4, the application was allowed, notice of allowance was set out, and we contend that represents much better the particular apparatus that the inventor intended to claim.

Now, after that they refused to pay the final fee, and then renewed, and in the renewal application they put in some very broad claims, these being used by the attorney for the Isko Company, who had bought, in the meantime, the Wolf patent, along with a number of others.

The Court: The application?

Mr. Frye: Well, the application then, but a different set of attorneys came along and proposed broad claims for the first time. Those broad claims were put in in November 1916, the patent in suit having been filed in December of 1913, a three-year interval before the broad claims which include the four in suit.

The Court: When was the patent allowed that was allowed last?

Mr. Frye: Less than two years from this date. It was allowed May 23, 1916, that is the date of the notice of allowance.

The Court: When did the new attorneys come in?

Mr. Frye: In November 1916. Now then they argued the question about process, claims, the allowability of the broad claims, and so forth, with which we will not burden you at the present time, and this affidavit I referred to was put in in 1917, and finaly the examiner refused to allow certain claims, and the appeal was taken.

The Court: In this he allowed the same ones that had been allowed before.

Mr. Frye: Yes, the specific claims, and I believe some others, your Honor.

Now, in the argument before the Examiner this statement is made by the attorney for the applicant: "Further there is a particular combination between use of sulphur dioxide and air cooling as we will now explain. Heretofore ammonia has been employed almost universally as a refrigerating agent, whereas the use of sulphur dioxide has been practically nil. The boiling point or condensing temperature of the ammonia at the pressures usually employed in the condenser is below the usual temperature of the atmosphere, hence the air cooled condenser could not be efficiently used with ammonia. On the other hand the boiling point, or condensing temperature of sulphur dioxide at the pressures in the condenser is above the temperature of the atmosphere, and consequently sulphur dioxide can be condensed in an air cooled condenser. This indicates a discovery and invention that it was obvious is negatived by the fact that it was not discovered by any of the many skilled inventors seeking the same goal."

We contend just that, your Honor, that that is not the discovery or invention.

Mr. Cooper: We admit it. We don't have any such claim.

Mr. Frye: We will also show that the use of ammonia in air cooled condensers was rather common before the date of the filing of this.

The Court. The ammonia or sulphur dioxide?

Mr. Frye: The ammonia, your Honor, which he says cannot be used for air cooling. We will show an ammonia machine which is used in the summer time with water cooling condensers, that they would shut off the water in the winter time, not once, but in practically every town where they used them. We have examples in specific locations. The same condenser was used in the winter months without water, and in the summer months with water. There are other examples that I can point out particularly.

Now, the Examiner having rejected it finally, an appeal was taken, and in the brief on appeal this statement was made:

"According to the present invention this defect and the trouble and bother resulting therefrom has been eliminated by providing an air cooled condenser. Moreover applicant employs sulphur dioxide as the refrigerant, and this is an important feature, because there is a co-operation between an air cooled condenser and a material like sulphur dioxide as a refrigerant. When ammonia is employed as a refrigerating agent this boiling point at the pressures in the condenser is below the atmospheric temperature."

The Court: Is that true?

Mr. Frye: We think not and will endeavor to prove it by experts.

"As compared to ammonia, sulphur dioxide, and the pressure in the condenser, has a boiling point above the atmospheric pressure."

The Court: That is true, isn't it?

Mr. Frye: I think so. (Continuing reading.) "Hence with an air cooled condenser as the air is at a lower temperature at the liquefying point than the compressed sulphur dioxide, it may be condensed efficiently. In view of the above it also will be seen that the present invention fills a long felt want and opens up the way for the manufacture and sale of a simple, dependable, household refrigerating plant."

Then he goes on into the other argument.

We believe there is no special combination between sulphur dioxide with an air cooled condenser; we believe in fact it is worse in many respects than ammonia, and of course than other refrigerants such as methyl chloride, in constant every-day use by refrigerator manufacturers.

The Court: What do you mean by "Worse"?

Mr. Frye: Well, that it actually has a disadvantage in place of any special advantage.

The Court: I don't think I just get the force of that. You use sulphur dioxide, don't you?

Mr. Frye: No, we use methyl chloride, which is another of the volatile gases. The plaintiff here uses sulphur dioxide.

The Court: But the claim of infringement is not because of your using sulphur dioxide?

Mr. Frye: As I understand it it is a common refrigerant.

We desire to point out that the file wrapper not only said it was perfect, but there was a special point which we believe to be an absolute misalignment of truth.

The Court: In the disclaimer what is said about that?

Mr. Frye: Nothing at all, your Honor. It goes to the dimensions only.

Now, there is another objection that could be raised from the file wrapper, and was raised by the examiner, and that is what we call double patenting. The same inventor filed patents ahead of the patent in suit in which there were no claims, broadly, to the air cooled condensing, or combinations of air cooled condenser with certain other parts. Before that patent issued the present application was filed. As I have pointed out, the broad claims were not put in until 1916, and in 1915 this particular patent, the first filed Wolf patent, issued. It is particularly noticeable because in the Kramer patent it was cited by the Examiner as anticipating Kramer on air cooled condensers.

The Court: You are talking about the Wolf patent?

Mr. Frye: Yes, sir, not the one in suit, but an earlier one, filed by Wolf, an earlier Wolf patent that clearly shows an air cooled condenser and a fan. That condenser is of a different style?

The Court: You don't claim it?

Mr. Frye: We don't claim it.

The Court: Was it so long ahead he could not come in and claim what he had shown in the patent?

Mr. Frye: Well, we contend, your Honor, that when we have co-pending applications you will have your broad claims in either the first filed or first issued, and that neither was done in the present case. Now, for example, in January 1915 this first filed Wolf patent issued, and late in 1920, in April, when the patent in suit was granted, that the broad claims—it looked to the world as though no broad claims had been made to air cooling in the Wolf patents. Here was one filed early and issued early; there was a second one filed, and co-pending and also issued, I believe, in 1917.

Now the Examiner issued these patents to protect folks like Kramer, as we find from his file wrapper as showing air cooled condensers in combination with other parts.

Now, we believe there has been a dedication to the public, by not claiming this in the first filed application, or making any reference to it, so that the world generally would know that he was reserving the rights for the broad claims. Now, having dedicated to the public by not claiming in the first filed, or first issued application that it was too late for him to reopen it in 1916.

The Court: When was the first one?

Mr. Frye: In 1915, and filed in April 1913.

The Court: It was issued while the present patents in suit, Wolf patents, were pending?

First Wolf patent filed Dec. 23, 1913. Quotations from action by Board of Appeals.

Mr. Frye: Yes. The present one was co-pending with this patent already filed in December, December 23, 1913.

The Court: Is there some law on that?

Mr. Frye: Yes, your Honor, we will have some argument on that.

Now, I desire to call attention to a quotation from the language of the Board of Appeals and the appeal in the Wolf patent, and this, we believe is where they were misled.

"The appellant states that one of the principal defects in refrigerating devices of the general character herein involved has been the necessity of using water cooled condensers. According to the present invention the condenser is air cooled, which is rendered possible by the use of sulphur dioxide as the refrigerant. The appellant asserts that was one of co-operation between the air cooled condenser and the ordinary refrigerant specified, since the ordinary refrigerants such as ammonia have boiling points at the pressure in the condenser below the atmospheric temperature, hence the air cooled condenser could not be employed efficiently for ammonia, or the like were the refrigerating agents and sulphur dioxide, on the other hand, at the pressure in the condenser has a boiling point above the atmospheric temperature, hence that on an air cooled condenser, as the air is at a lower temperature than the liquifying point of the compressed sulphur dioxide it may be condensed efficiently."

Then he goes on and argues the question of double patenting, and decides against that, and allows the claims.

The Court: What do they say about double patenting?

Mr. Frye: I can read it: "The appeal claims on the other hand involving the use of sulphur dioxide in combination where it has advantages above set forth are utilized. Such combinations are entirely independent of the particular form of mechanical feeding device employed and to limit the claim to both features would obviously subject it to the charge of aggregation, which would therefore appear to be clear that the appeal claims in those of the patent do not differ merely in scope, but rather cover separate indivisible inventions. While it is true that the patent discloses subject matter upon which certain of the appeal claims are founded, that is, the use of sulphur dioxide as a refrigerant in the refrigerating systems, such subject matter is not claimed in the patent, and the disclosure as to this subject matter was entirely superfluous, so far as the invention is concerned. We must therefore hold that the invention taught by the filed claims is divisible from that covered by the claims of the patent."

The Court: Isn't that pretty good argument?

Mr. Frye: Well, it held in that case, but we believe it is not, your Honor.

Now, while we are on the Wolf patent, we desire to show that household refrigerators were in public use long ahead of the particular filing date of the Wolf patent. We also believe that the 3-8 copper tubing, quarter inch, half inch, or whatever was used, was an ordinary, every-day article of commerce, used extensively in such arts as the automobile art, chemical art, for stills, and so forth, and could be bought in any hardware store, and that in, for example, the Wolf patent, the particular use of 3-8 inch pipe was because it was easy to obtain, as well as because it had been computed to be what was absolutely necessary or needed in the case.

Had it been used in other refrigerators?

Mr. Frye: We believe we can show you, while it is not mentioned, it is quite unusual, as you know, to mention dimensions of things, that by comparing such things as a spigot, in, for example, a water cooler, such as you use in a room, that is not going to be two or three inches in diameter, we know that, and we will show cooling coils, and condensing coils of a smaller bore than the spigot that would certainly tend to prove that they intended to use a small flexible pipe because it is coiled around in a helix, or shaped in ways that would make it rather difficult to use other than a flexible pipe such as a copper tube.

Now that history we expect to bring out in rather great detail, if your Honor will permit us to, and we want to show that while they have actually contributed nothing that was not known at the time, we will show that they have actually contributed nothing that was not known at the time they entered the field. Air cooled condensers were known, copper tubes of 3-8 inch, or any other sizes, were known, and they were standard in hardware stores. One place they were used was in beer coolers, in every bar room, almost, they had a place for ice, an ice chamber, with a multiplicity of copper coils, usually of 3-8 or 1-2 inch in diameter. And there are other examples we are going to try to bring out; but in this history we hope to show that every element, and the combination of elements, was known to the mechanical engineers in the refrigerating art, and we will try to detail by one or two, or perhaps more, such engineers, who have had experiences of 15 to 30 or more years.

(Continued on page 26)

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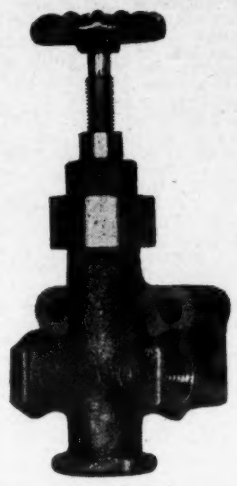

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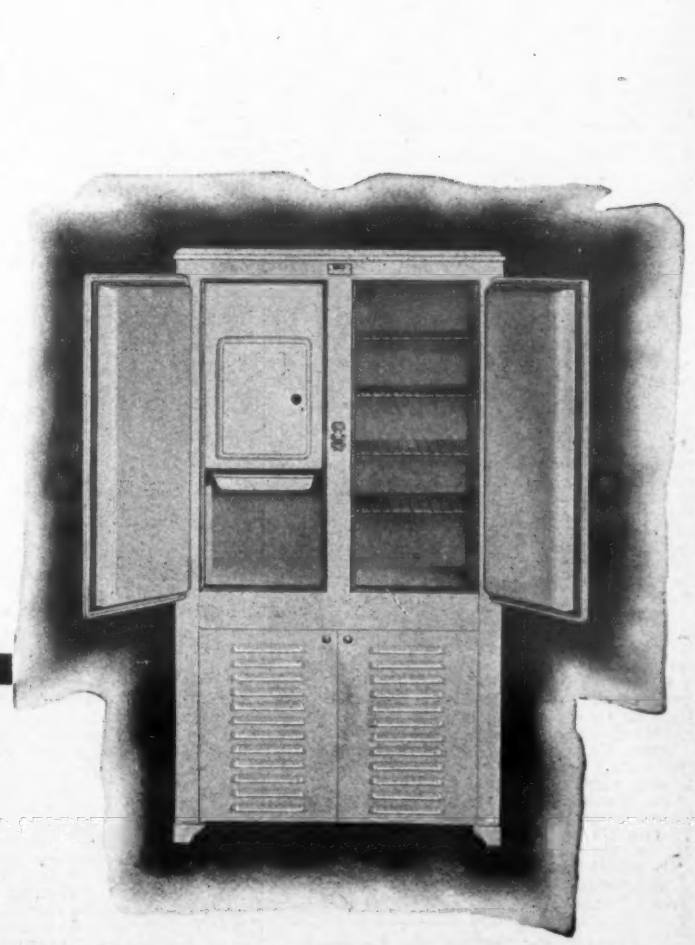

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Counsel argues against the disclaimer.

Now, I believe that ends the defenses against the Wolf patent, though of course, we claim that we do not infringe. We believe that the disclaimer, so called, is an improper disclaimer in that it attempts to modify one element of a combination. Now, just as the Examiner in Chief referred to the question of aggregation, when you attempt to enlarge specifically one of the elements that has been previously broadly stated in the combination, we get squarely up to the question of aggregation.

Now, it has also been held that where you get what was obviously intended for a broad claim, that in order to change that claim into a specific one, it requires a new issue. We believe that that is the way that it should have been done, and it could have been done, because the laws permit re-issue, even after two years, when the claim is to be narrowed. We admit that this is a narrowing of the claims 10 and 15 that were disclaimed, but we contend that it is an improper narrowing and should have been done, if at all, by re-issue and not by disclaimer.

The Court: I have not yet discovered that the Court put any limit on what you can disclaim. You can claim the earth, and finally disclaim everything only the house you live in.

Mr. Frye: Well, the main position we are going to rely on, your Honor, is what we find is the latest decision in the case. It is by the Circuit Court of Appeals of the Second Circuit in 1928, the Grasselli Chemical Company versus The National Aniline & Chemical Company, reported at 26 Fed. 2—305. The quotation that I have in my hand says:

"A disclaimer is applicable only as to a part distinguishable on the face of the specification from the remainder. Otherwise, the disclaimer could succeed only by interpolating a limitation into the part which must remain, and such corrections must be made by re-issue and not by disclaimer."

Now, that is even subsequent to the well known Permutat case of the 6th Circuit.

Mr. Cooper: But there is one in the advance sheets two weeks ago from the 6th Circuit Court of Appeals, where it stands again on the Permutat case, on exactly that point.

Mr. Frye: Well, I have not seen that particular one referred to.

The Court: I have not discovered any limitations in the 6th Circuit at all on disclaimer.

Mr. Cooper: Neither have I.

Mr. Frye: Well, there was a rehearing in the Permutat case. I have both of those, and then if we have something after that, I have not seen it.

Mr. Cooper: It is not in the Permutat case. It is in an opinion that I happened to see two or three weeks ago, where they re-state the Permutat rule and say that they stand by it.

Mr. Frye: Well, we are expressing our contention at the present moment, and of course, we realize we are in the 6th Circuit..

Now, passing on the defenses against the Kramer patent, we contend that the Kramer patent is an attempt to cover location of an element or a combination of elements rather than some particular novelty in the elements or combination themselves. In other words, precisely the elements of the combination of the claims of the Kramer patent were shown by Wolf and others, above the refrigerating chamber, and the only distinction between at least one or more of the claims in issue, and that, is their location beneath the refrigerating chamber.

There is also the question of movability or removabality of the elements as mounted below the base. We claim we do not infringe the removability or movability feature of the claims in suit, that it would be the height of folly for any man skilled in the art to take that base, meaning the parts on which the motor, compressor, etc., are mounted, out of there for the purpose of repair or otherwise. It is much easier, much simpler, to remove individual items. Means are provided, valves, etc., for doing everything you need and that accordingly, there was no intent, and only by a forced and we believe highly improbable relation of the use of those elements can we be interpreted as infringing the claims relating to the removable elements.

Now, certain of the claims, say for instance, claim 3, says: "A movable support located beneath the bottom of the refrigerator casing."

Claim 4 in the same element says, "A movable support located below the cooling chamber," and claim 5 merely says: "A cooling chamber, a chamber located below the refrigerator body and detachable connections and condenser and so forth located in the chamber."

We contend that that claim has not even the element of movability or removability or slidability of the remaining claims in issue, and is an attempt to obtain nothing more than move the identical things of the prior Wolf patent and others from the top to the bottom of the refrigerating box. Now, that such is their intent is known from the file wrapper.

Now, going on, claim 6 calls for a movable support located in a recess, and the recess is located beneath the box.

Claim 7 claims a support located below the cooling chamber, and mounted so that it can be withdrawn frontwise of the refrigerator body.

Claim 8 says a movable support located beneath the chamber and forming, with the bottom of the refrigerator body, a holding recess open at the ends.

Now, we contend, your Honor, that this particular patent is also not one that rises to the dignity of invention, therefore invalid, that the file wrapper very clearly shows what was intended to be patented by the claims in suit, and after rejection of all the claims in suit, the attorney tells of an interview—

The Court: On what ground was it rejected, first?

Patent No. 962704 to Emerson and Bishop cited.

Mr. Frye: Claims 5 and 6, which were previously regarded as patentable—that is now, I believe, 3 and 4 of the present application—claims 7 and 8 are rejected on the patent to Emerson, et al, 962704. Emerson et al, we have here, if you desire to look at it. It shows the entire box with the parts of the combination above the box.

Are you familiar with Emerson?

A Voice: Emerson and Bishop?

Mr. Frye: Emerson and Bishop, yes.

Now, here is the chamber for the several elements, condenser, compressor and motor, all located in the chamber, removably arranged above the box except for connections as between the condensing coils and the refrigerating coils.

The Court: Which it is necessary to have?

Mr. Frye: Oh, it must have, of course. Now, they rejected it on that patent, saying, "It differs from the patented structure merely in the provision of detachable connections in the refrigerating pipes. Such connections are very common, and the addition of same wherever it may be desired involves no invention. The Emerson patent shows the motor, compressor and condenser mounted on a bed plate which rests on the top of the refrigerator, and it is not seen that any invention is involved in merely placing the apparatus on a shelf on the bottom of the refrigerator instead of on top."

It is rather clearly on the point.

They then tell of an argument with the Examiner during the interview, during which the attorney convinced the Examiner that he should change his views on the allowability of these claims, and he recites 8, I believe, six separate reasons—why the arrangement below the box is patentable over the arrangement above.

The Court: The examiner?

Mr. Frye: No, this is the argument of the attorney, and it convinced the Examiner to the extent that he allowed the claims.

The Court: The Examiner did not say which one of those he relied on?

Mr. Frye: No, he did not.

The Court: Well, let me have the arguments then, from the attorney.

Arguments in favor of putting the machine in lower compartment of cabinet are given in Kramer patent.

Mr. Frye: (Reading) "1. The air circulated through the parts carried in the chamber at the bottom of the box is air at the bottom of the room, consequently is cooler. This is a matter of importance, particularly where the refrigerator is installed in small, low ceiling rooms, as pantries, where because of the room construction, the air at the top is liable to be quite hot, requiring a larger consumption of current to effect the required degree of cooling, consequently causing the refrigerator to be more expensive to run."

Now, we all know that air is cooler as you get near the floor. This particular inventor did not discover it, and his reference to a small room, we believe to be particularly bad, because when you run a fan in a small room it takes but a very short time to get the air to practically the same degree of temperature at the top or bottom, and particularly as any room that has such a ceiling, so low that you get this close to the top, would be a very poor and unlikely place for a refrigerator. However, the argument is quite clear.

The second argument is: "With the construction called for by the claims, the moving parts are out of the way and do not require any special feature or features for guarding them."

The Court: I don't see that.

Mr. Frye: Well, your Honor, it is a chamber which, as I take it, is an enclosure, and it is put below the box, where they say it is out of the way. I would say that the one above is equally out of the way; in fact, probably more out of the way of children and cats, and so forth, that are likely to be in houses.

The third argument is: "The box may be built to required height and the parts installed without either increasing the height or making the parts difficult to get at and remove, consequently may be installed without losing operating space. That is to say, the food storage chambers, at a height convenient to access and of satisfactory dimensions. Ordinarily, the ice box is built up to a certain required height, and there is a certain amount of waste space beneath the box. With the construction called for by the claims, this space beneath the box is utilized."

The Court: So far, they are all advantages, but none of them point out any difficult thing—

Mr. Frye: Any patentable merit.

The fourth argument is: "A better balanced construction is provided, because the weight is at the bottom of the box, consequently the box has a lower center of gravity, which prevents to some extent vibration, and the parts are not so shaken by the vibration. This is particularly important in providing a longer length for the parts, and particularly in preventing loosening of the pipe connections. Less repairs and adjustments are therefore necessary."

The fifth argument is: "With the parts located as called for in the claim, they are much easier to shift for the purpose of cleaning or removal than if placed at a considerable height, as when located at the top of the box as disclosed in the reference."

The sixth argument is: "In the construction shown in the reference, nothing, of course, can be placed on the top of the box, which, where space for storage of articles is a desideratum, as is the case in most private houses, is a very great disadvantage."

And that ends the arguments, and the Examiner allowed the claims by a note of allowance, without further argument.

We contend, your Honor, that that points out why the inventor and his attorney thought a patent should be allowed. We desire to have your Honor test and see whether a mistake was made by the patent examiner. This is the first chance there has been for correcting such a mistake, if any were made. We contend that those so-called arguments are merely advantages, or the usual well known arrangements of parts placed in a slightly different location, which is not sufficient to invention.

Furthermore, in the prior art, we will show that all of the parts of the combinations have been located in the compartments adjacent to the bottom of the box, or at the bottom of the box, also at the sides of the box, in a compartment in the rear of the box, a compartment adjacent to the top of the box, and that it had been something for a mechanical engineer or designer to pick and choose from prior art or prior uses.

Patent No. 111778 issued to Carlson in 1914 offered as example of prior art.

One example of this I would like to call to your attention at the present time, which we believe will show as clearly as any that I can get quickly. It is an enlarged drawing of the patent to Carlson, 111778, patented November, 1914, and filed well ahead of the Kramer patent. In fact, the Kramer patent, your Honor, was not filed until 1915, subsequent to the date of issue of the patent to Carlson. Now, the red in the drawing before you, is the condenser. It happens to be a water cooled condenser. The part marked 2, you can tell from this—

The Court: By the way, does he claim air cooled?

Mr. Frye: No, in none of the claims in issue, but he shows an air cooled condenser and describes it, of course.

Now, the green in the patent before you is the cooling or refrigerating coils. The part marked 2 is the motor, the part marked 1, easily seen at the figure to the left, is the compressor. There are removable connections, ordinarily, all of which with the exception of the cooling elements, are located below a compartment of the box which is used for food storage and particularly described as usable in the manufacture of ice cream.

The Court: Is figure 4 a different—that is the end view?

Mr. Frye: No, an end view looking in this direction, your Honor.

The Court: The other is a side view, looking at it from the broad side.

Mr. Frye: It is a section, your Honor, yes. Now, there is the arrangement of the several parts of the combination, so called, motor, compressor, condenser, on a single base, arranged in a compartment below the refrigerating space of an ice box. We contend that is a household refrigerator—

The Court: Well, is this space for refrigeration?

Mr. Frye: He describes this space over here as what we would call equivalent to the space that you see in the boxes here. Then he describes a special compartment here, wherein he can place an ice cream freezer, but he shows the coil running through there, and he shows space exterior of the ice cream freezer, in which you could put food or other things that you want stored.

But we contend that even ice cream is a food, and there is certainly space for storage of other foods, and it is certainly arranged so as to be on a separate base below the refrigerated area. Furthermore, your Honor, we believe that the particular showing of the mounting of the base in the Carlson patent is as nearly removable or slidable, or movable, or whatever term you desire to use, as is the same member in the defendant's machine.

The Court: Was Carlson's sent in to the patent offices?

Mr. Frye: It was not, your Honor. We have all of the file wrapper, all of the file wrapper references, and Carlson is not among them.

The Court: The condenser does not set directly on the base?

Mr. Frye: It actually does, your Honor.

The Court: Where is the motor?

Mr. Frye: The motor is under a bracket.

The Court: Where is the condenser.

Mr. Frye: Well, here in your condenser support—that runs down there (indicating), straddles this part.

The Court: I mean, it is set directly—

Mr. Frye: Oh, it is on stilts, so to speak, or legs, which legs are on the base; but even if it were on the top of the motor casing, your Honor, we believe it should be called one base. Of course, we will have that interpreted by the expert, but I wanted to show an example of the prior art that we believe anticipates this patent.

The Court: So there is not anything in Carlson to indicate that they had the thought of having it as a unit, and putting it in and taking it out, is there?

Mr. Frye: No, your Honor, except that it shows detachable connections.

The Court: But your contention in that regard is that the patent was finally allowed—

Mr. Frye: On a fallacious argument, your Honor.

The Court: On the position of it ?

Mr. Frye: On the location.

The Court: The advantages—

Mr. Frye: The advantages.

The Court: Below or above?

Mr. Frye: That is our contention, your Honor, and we believe that this, had it been known to the Examiner would have defeated the patent by never allowing the claim.

Counsel gives arguments against putting the compressor underneath the food compartment.

Of course, we also contend, your Honor, that there is no advantage, economically, or otherwise, in locating your unit below the box, but above the box as shown in the Wolf patent, for example, that was in this suit, the early Wolf patent, you actually get less consumption of current and a more economically running job, with equal efficiency.

The Court: There must be some reason for it.

Mr. Frye: Well, the reason, as we contend, is that you have to have a roof over the arrangement below the box, and the compartment sort of retains heat, so that even if the air at the floor is cooler, the air that contacts that condenser is really warmer, because it is heated by the compressor and by the moving parts in the condenser itself, because of lack of movement; that when you put it on top of the box, unenclosed, you get a better circulation than even if the air itself should be warmer; it will be a better and more efficient and more economical job.

The Court: Well, isn't this the main reason; That it puts your space for the use of the housewife and the maid and the children, and the old man when he wants to go to it, at a handier place, and that that space down below is not very convenient.

Mr. Frye: It is our contention that convenience of location of either the parts or the refrigerating area is the only advantage and the only reason why the defendant, for example, arranged its machine as it did. There is no advantage economically, and in fact, this arrangement in the cold part of the room has a double effect, because you use your refrigerator area more during 24 hours than you do your motoring part, but if you put it up at a warmer temperature, you are actually making it necessary for you to cool more; in other words, if you put the part that you keep your food in high, in warm air, you are suffering a disadvantage greater than if you used colder air at the floor for your condenser.

The Court: How much difference is there in the temperature in the ordinary kitchen? Has anybody prepared—

Mr. Frye: Why, yes, it will be prepared. We have an exhibit in the hotel room, the Wenonah, that we desire to have your Honor visit there if you can, rather than to bring it over here. We have, I think, five thermometers located one foot apart from the floor up to the box top, and we take one unit exactly like the one here, placed on top of the box, with the box merely cut away and set on the floor, and this piece put up and moved on top.

Now, we have records for a considerable length of time, but we would prefer that the engineers for plaintiff check the data and the tests right while we are here in Bay City. In other words, we would like to have a man appointed by their side and one by ours to keep a record of the readings to see just what is being done, and then each side can argue from that test. If they have a similar or a different test, we will be glad to reciprocate.

We believe that during the remaining days of this trial, which I think will be at least three, we can get sufficient data to fortify our arguments. If we cannot, we are prepared to withdraw that argument. So far, all our tests would seem to indicate that it just as efficient when put on top, if not more so, than below; that even the apparently most potent of his six arguments falls by the wayside in actual tests.

Now, there is a question raised in the answer also and to the question of double patenting in the Kramer patent. That relates generally to the other Kramer patent that the witness yesterday referred as along the same line as the patent in suit, or words to that effect.

Mr. Cooper: What Kramer patent is it that you say is the double of this Kramer patent in suit? I would like to get that.

Mr. Frye: The number of it is "1281047."

Mr. Cooper: Well then, it did not issue until after this.

Mr. Frye: It was the other of the two Kramer patents in suit.

Mr. Cooper: But I say it did not issue until after the one in suit, and you say it is a double, it anticipates the one in suit, is that it? I just want to get you to define your position.

Mr. Frye: The question as to whether we will rely on this or not, has not been decided. I am merely picking out at this time the defense set up in the answer.

Mr. Cooper: Oh, speculative?

Mr. Frye: No. Personally I believe it was directed primarily against the other of the Kramer patents, and now that you have withdrawn that other patent, that we will withdraw the argument of double patenting.

Mr. Cooper: Well then, may we understand that that point is out of the case?

Mr. Frye: At present, yes, but I will say I will try to detail to his Honor our several defenses.

Mr. Cooper: Well, I want to know what I have to meet, and I understand that this is merely speculative—see if the other thing sticks, and if the other defenses do not stick, then you may come to this one.

Mr. Frye: No, that was not the idea. We were detailing what was put in, and the ones that we rely upon and will most diligently press, are, that there is no invention in the Kramer patent, and that if there was any at any time, it is shown in prior art references, such as the patent here and others.

The Court: Well, does the Kramer patent, by its language, rely on the unit being able to be put in and taken out? The argument on that did not seem to be based on that, of the attorney. The patent itself I thought should rely on the other, from the unit proposition.

Mr. Frye: The claims of the patent in suit, your Honor, all recite a movable support except claim 5, but all of them recite the arrangement of these several elements, recited various ways, either below the box or in a chamber below the box, or in a recess or something of that kind below the box.

The Court: Even though the lawyer really got past with the argument about it being below instead of above, if there was enough of merit in being a unit to be a good patent, I take it that it would have to be sustained, in spite of the fact.

Mr. Frye: That is true, your Honor. We believe we have convincing evidence that it was old in the prior art to have it on a single base, which base could be moved either by sliding or otherwise. I am not certain, I have one that I can show quickly. I do not seem to have at the present moment an enlarged drawing of an instance of that kind, but we have several of them recited in the answer.

Assembly of parts on a common base shown in patent No. A76,358 to Ballantyne, No. 598,814 to Reed and No. 623,270 to Bloch.

An example that I will show you from a small patent is that to Ballantyne, No. 476,358, wherein all the elements are put on a base which is clamped to the side of a refrigerated area, in a compartment at the side of the refrigerated area.

Now, we contend that the removability of that, upon the removal of these bolts, is precisely the same as the removability of ours upon the removal of the bolts.

Another example would be the patent to Reed, which shows a machine in which all parts except the cooling coils are mounted upon a single base, the motor being carried by a shelf that extends from the body of the base. That particular one, we take it, can be set in the cellar below or in a compartment below, in a compartment beside or behind. Whatever removable features go to removing the entire thing as a unit are not inherent in Kramer, but rather, are old in lots of patents.

The number of this Reed patent is 598,-814.

Now, we could continue with several of these: The patent to Bloch, 623,270, showing everything mounted on a single base, the condenser at the right, the compressor at the left and the motor at the extreme left and so on. The number is 8,232,370, April 18, 1899.

The Court: That, of course, was intended to be—

Mr. Frye: Placed wherever you desire.

The Court: Outside all the while?

Mr. Frye: Yes, like on the floor of the cellar, or of course on the floor beside the big box. We will show you examples, your Honor, of where they were used in small butcher boxes, for example, where we have

(Continued on page 27)

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Testimony by Harry C. Hayes, Chief Engineer for Absopure

a shelf put on the outside, actual installations of them, not only patents.

Now, here in Marshall is one where the chamber is apparently back of the box. This number is 630,616. That one does not, however, seem to have it all on a single base. That was cited merely for the arrangement of a chamber wherein are contained the necessary elements of the combination, wherever desired. We do not believe that it was greatly thought of, to change it from the side to the back, or from the top to the bottom.

Emerson and Bishop you are familiar with.

Another example is that of patent to Hapgood, 1,046,588, wherein all the parts are mounted on a single base, the motor being mounted on a shelf extending to the left of the main or body of the housing, figure 7 very clearly showing the mounting. The condenser is above the motor, the motor, compressor and so forth being clearly evident.

Now, we could go on with a number of such examples, but I think we will leave the further ones to the expert.

Now, your Honor, that is a brief summary of what we believe will be proven, and we would like in addition to have the engineer of the defendants employed here to sort of inform you of refrigeration generally—that is, if it is necessary, for example, have a little experiment with a volatile liquid, sulphur dioxide or methyl chloride—that we would be glad to do it. In other words, we would like, before we begin our case proper, to take every step to see that you understand all phases of refrigeration that you think will be in point.

The Court: I will welcome it.

Harry C. Hayes, Chief Engineer, General Necessities Corp., testifies.

Harry C. Hayes was thereupon called as a witness on behalf of the defendant, and being first duly sworn, testified as follows:

Direct Examination

By Mr. Frye:

Q. 1 Will you state your name, address, residence and occupation?

A. I live in the city of Detroit, I am employed by the General Necessities Corporation as Chief Engineer, and have been so employed for the last eleven years.

Q. 2 What experience have you had in connection with the refrigeration industry, ahead of coming with the defendants?

A. The first of it began about 1900, when I started to work as a laborer in an ice plant in Indiana. I worked there off and on for several years, besides going back to school in the meantime; later came to Detroit, ran small power plants as an operating engineer, taking out an operating license in the city of Detroit in 1904—1906, I should say, as a first class engineer.

Then I went to work for a large ice company as an assistant engineer, in a large plant, which position I held for about two years; left there and went to a small power plant in the downtown district as chief engineer, stayed there for about five and one half years, then came to what was then the Peoples Ice Company, but was later succeeded by the General Necessities Corporation, and took charge of what was then their largest ice plant, which I operated for some time—by that I mean possibly a year or two years—then later became their division operating engineer, and finally the chief engineer of the company.

In that capacity I had charge of the operation of the plants, designed the plants that were built later, quite a few of them, in fact; in fact most of the ice plants in Detroit I have either designed for that company or someone else.

During those years I also acted as consulting engineer for various refrigerating propositions by the plants over the country, as well as in Detroit.

That building consisted of the design and the construction under my supervision. We, instead of buying a plant outright, generally bought the parts, refrigerating machinery—that is, compressor alone, motors, pipes, or steam engines, as the case might be, the various parts of the plant, including the pipe, shipped raw without threads and so forth, and made it up into an ice plant after the designs that we had made.

Also, in that period, designed ice cream plants and building equipment such as—well, one example was the refrigerating plant for the Indianapolis Athletic Club, and other things of that kind.

I also observed, both types of refrigerating machines, or rather, I should say, the same type in smaller units, and in that connection was called in, in consultation by some of the large companies then making such machinery.

I, in my work as a consulting engineer, made trips about the country, in anyone's interest that cared for investigation either in this particular line of work or other branches of refrigeration.

In 1920 I took the examination and registered as a professional mechanical engineer in the city of Detroit, or rather, under the laws of Michigan, and of course have held such a certificate since that time.

In 1924 I was sent to Europe to investigate certain refrigeration situations there, and did that in France and in Germany, and returned to America and made my report to principals that sent me. Since that time, in the later years, I have continued to act as chief engineer for the General Necessities Corporation; and when they took on the activity of manufacturing a small refrigerating machine, that was also dumped in my lap, and as before, I had had the job of organizing the engineering personnel, and this was also given to me. In this case it meant design after we began to design new stuff. Our first machine was purchased, the machine that is at issue here was purchased, from another company that had been manufacturing for some time, but when new design began I had charge of that, and the engineering personnel—anything that went with the mechanical end of the company.

That in brief is the experience generally for the last 28 years.

Q. 3 And you have personally designed, built, assembled and or operated refrigerating devices for making ice or refrigerating spaces such as food areas, in both large and small refrigeration?

A. Yes, almost every description.

Q. 4 Well now, is there any difference in principle or theory between the refrigeration in these large and small devices?

A. Absolutely no, it is just exactly the same.

Q. 5 Well now, will you rather briefly, if possible, tell to his Honor the principle of this refrigeration, and illustrate it, if necessary, by any figures or apparatus you have at hand.

WITNESS

Harry C. Hayes

Mr. Cooper: Are you attacking there the general statement of the theory of operation that has been made on our side?

Mr. Frye: We are attempting to convey to his Honor whatever he would like to know about it, and we expect by this witness to tell the theory of large and small refrigerations, with whatever differences there are, if any.

Mr. Cooper: Thank you for your oration. I wish to repeat my question.

Mr. Frye: I think I have answered your question, Mr. Cooper.

Mr. Cooper: Oh, go on, go on.

A. I think possibly I could shorten the time there by reading directly a part of an article from our service manual that I wrote, which makes the thing go along rather consecutively; or I can talk purely from memory.

Mr. Cooper: Wouldn't it be just as well to put in a book and let us read if for ourselves? It is no use, it seems to me, to expand that on the record at all.

Q. 6 Are we to understand, Mr. Witness, that you are to use that book as a text, or as a reference book?

A. No, no, no; just to keep the paragraphs in order. I could copy it on a piece of paper and refer to it; I wrote the article.

The Court: You may use it.

Mr. Cooper: The only objection I have is that it seems an unnecessary waste of time. I have not been answered yet as to whether this is a matter on which you oppose us.

Mr. Frye: In some respects we oppose, and in others we agree with the statement by your expert.

Mr. Cooper: Well, let's get down to where you oppose, then. It is no use to go on over what you agree on, in a case.

A. I think I will begin with a little discussion of heat and cold.

Witness explains temperature requirements for different applications of refrigeration.

In this we say that in any discussion of this kind, of course any discussion about refrigeration, heat is the first consideration; and when we are speaking of heat, your Honor, we also mean cold, because after all, the terms "heat" and "cold" are merely relative. When we speak of "cold," we merely mean the absence of heat, as compared in warmth or cold, of course, according to our senses. For instance, you may say that it is cold outside on any day when the temperature is 40 degrees, but if we are to go into a cold refrigerator room—and we have such rooms in Detroit, in our company—where the temperature is 10 or 30 degrees above zero, that room would be considered cold compared with the weather outside. The weather would then be warm compared with the room.

If we carried that still further, if we had another room where the temperature was supposed to be about five or ten below zero—we have also many of that kind of rooms in refrigerating and cold storage industries — but which room, through the inattention of an employee or for some other reason, had come up in temperature, say, until it was 10 or 20 degrees above zero, the very thing that I considered cold a while ago, of course, would be considered very very warm then, and utterly unfit, for the purpose for which we were carrying it. In other words, the thought—

The Court: Why do you need it colder than freezing? Why do you need in some places, colder than freezing?

The Witness: Because, for instance, in the canned egg proposition, eggs are broken, many of them, in China and shipped here in cans, and frozen hard. If they were allowed to thaw—which they would do at considerably below the freezing point of water—in other words, where water would freeze at 32, these eggs would melt and so spoil.

Also in the frozen meat industry and also in the ice cream industry. For instance, ice cream is made in the freezer at about 28 degrees, that is, about that when it comes out of the freezer, although the brine used for cooling it is probably about 6 degrees above zero, and that cream is then put in a can in a hardening room that is all the way from zero to 17 below, in order to quickly set it. That is some of the reasons why we need colder than freezing rooms.

The Court: You need it cold enough to freeze whatever you want to keep there?

The Witness: Yes. Parke, Davis & Company have a room that I understand they carry around 75 degrees below zero when they use it; they use it for freezing certain glands or extracts thereof, they freeze out the undesirable portions. In the oil refining business also they have very low temperatures to freeze out undesirable parts of the cold test oil. Of course it has been pointed out here that heat is measurable, a measurable thing; it is not tangible in that respect, it hasn't dimensions and cannot be weighed, but it is nevertheless measurable, and if an object has a certain temperature the more heat that is introduced into the object, it weighs no more but has increased in heat content; it is not measured by the weighing scale, but we do have a unit of measurement of that heat, the heat may be accurately measured.

Heat, like water, always flows down hill, that is, by that I mean not the heat scale, in fact I do not mean the altitude scale. Water, as we all know, of course, flows downward in the altitude scale; for instance, if a jar of water be turned over here it won't flow up but down, it will flow down, go on the floor, and if there was a hole there it would go down and continue until at its lowest level, but it will never flow up, and heat in the same respect also flows downward, however in the temperature scale.

The Court: It flows up, doesn't it?

The Witness: No, heat would flow downward in temperature scale, and by that I mean the scale of the thermometer. For instance, now, when I say downward, I mean only in the scale, not—for instance, the measure, instead of being feet and inches, it is in degrees.

The Court: It will go to where the temperature is lower.

The Witness: Correct, flow downward.

The Court: In the room, it will go up because the temperature is at the top—

The Witness: Yes, the heat passes up as a body, but it would only flow from one thing to another, because the temperature in the other thing is lower.

The Court: That is due to the expansion and contraction of the air; when it is hot—

The Witness: Yes, because of the heat, yes, sir.

The Court: That is a result.

The Witness: That is a result. To illustrate that, an object—

The Court: What you mean by that is that heat—two bodies together, one hotter than the other, the tendency is for the heat from the higher temperatured body to pass over into the lower?

The Witness: Absolutely correct.

The Court: All right.

The Witness: Yes, your Honor.

Q. 7 Will you give an example of the cycle wherein that is used, if you can?

A. Yes, in the refrigerating cycle. Presently I would like to cover in advance of that a little bit; for instance, your Honor just illustrated an example of that kind and I have given an actual example here

(Continued on Page 28)

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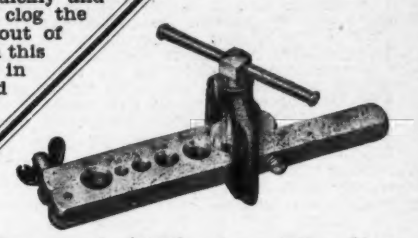

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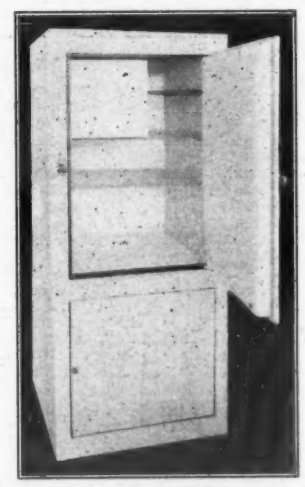

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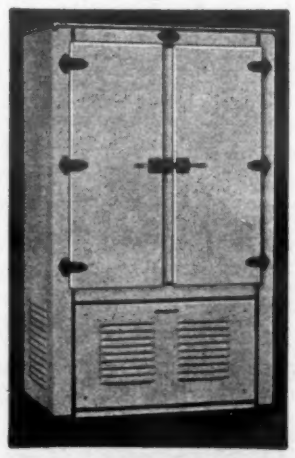

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Cooling Effect of Methyl Chloride Demonstrated

where something 200 degrees is placed adjacent to another thing, one being a hundred degrees of temperature, the scale using this measurement—now, 100 is of course a hundred less than 200 and of course, as you pointed out, it would flow to the lower object. Now, refrigeration is simply the removal of heat from a place where it is not desired to a place where its presence will be tolerated, at least. Refrigeration might be said, in other words, to be the movement of heat under control. For instance, to give a homely example of the flow of heat, using the domestic refrigerator, this is a very homely illustration, but points the thing out, I believe. Suppose, in the summer time, we put some object in a refrigerator, for instance, a water melon. They hold a lot of heat, and we also like them cold, so if the water melon were brought in the house in the hot summer time after it had been lying, we will say under a shed or in a wagon where the sun was beating on it, and it had acquired a great degree of heat, it might have come off a wagon or any place where a lot of heat would accumulate in the melon, and it is very warm, we will say about 90 degrees. Heat from the melon now begins to flow to the air inside of the refrigerator. It is quite cold, 42 degrees in the refrigerator, and the air in turn of course will begin to warm up by reason of the heat given to it by the water melon and if there is any object present to which the air can in turn give its heat, that object takes it up, and in the domestic refrigerator, of course, there is some object to which it can give its heat, and in this case let us assume that it is an evaporator or cooling part of the refrigerator which has been called by various names, but I think evaporator is a good name. In our particular machine it happens to be a cold tank, a tank filled with a non-freezing liquid, or at least a liquid that will freeze considerably below any temperature that we will be called upon to cool it to. That has been calcium chloride, brine, or salt brine, possibly, or at the present time we use a mixture of alcohol and water and that is what is in the machine before your Honor at this time. Now, we will assume that the heat that came into the refrigerator from the water-melon was passed from the water melon to the object and is now passed away into the air, into the evaporator, which has a temperature of, we will say, about 20 degrees. In all these steps it has been flowing down hill in the heat scale, at least. Inside of the tank, a body of, let us say brine, which has a temperature of 20 degrees, and the heat, of course, is not retained in the brine, because if it was the brine would continue to come up in temperature, but rather it is passed from that into the coil inside that has been pointed out here and called the evaportor coil. Now, the refrigerant inside of that coil, will have, in our particular case, about 6 degrees Fahrenheit temperature, and that is a rather popular temperature where you use a brine in connection with a coil inside. We observe in this that the heat is still traveling down hill, that is, by that I always mean in the thermometer scale. Down hill, of course, is just quoted with reference to that. Now, in this particular case we have nothing lower in the heat scale to which we can pass the heat, which is now in the brine. If we had something lower than that it would flow to that, but we haven't got that, so we have to use a mechanical force—

The Court: It does flow from the brine into the refrigerant?

The Witness: Yes, inside of the coil.

The Court: All right.

Mechanical force used to hoist the heat upward in the temperature scale.

The Witness: I meant to mention that. Now, we have nothing to which that can flow lower now, so we have to use some mechanical force to hoist this heat upward in the temperature scale in order that it may flow to something that is warmer just as if I had a tank in the basement here, that was, let us say, below sewer level, and there are many in the big cities, especially where you have city basements, and water won't flow any further down, because there is no sewer down there to take it, so we pump it up, hoist it high enough to make it available to run out in the sewer so it can flow away. In this case, we want to hoist the heat up above, upstairs so to speak, in the temperature scale, so it may flow away into something where its presence will not be a detriment, in so far as our purposes are concerned.

Now, right here it possibly might be well to discuss refrigerating mediums before going further into the description of the refrigerating business.

We all, of course, are aware of the fact that all liquids boil if sufficiently heated, if sufficient heat is applied to them; that means water, mercury, alcohol, or any other liquid I know of at the present time, even iron will boil if heat is continued to be applied to it. The phenomena of boiling is, as I say, familiar to all of us, and in water, we notice that as water boils the surface appears in agitated bubbles, bubbles seem to come up from below and break at the surface and then as vapor passes off from the water. If we were to place a thermometer into the water, boiling water, at an altitude of many thousand feet, as Mr. Cooper spoke of in his opening, we find that the thermometer reaches 212 degrees, and also as he spoke of, if we should—well, we know that at that altitude, that after it got to 212 degrees it would not get any warmer, although heat might be continued to be applied to the water and the vapors going away, the heat is carried off in steam, and there is a change of state.

Mr. Cooper: The same thing would be true of sea level, wouldn't it?

The Witness: I am speaking only of sea level right now.

Mr. Cooper: All right.

How water may boil and still be cold.

The Witness: Water at sea level, when it begins to boil you cannot increase the temperature any at sea level, but if I went below sea level, in a mine for instance, it would rise, or if I should confine the water in such a way that the vapor would not escape, but be confined in a closed vessel, such as a boiler, the temperature would rise, or at the mountain top, spoken of, it would be possible, I guess if we went into some airplane, to have boiling water, and possibly keep our hands in the water, without being injured thereby; and if I was to subject to the water in a high vacuum it would not be long before the water would boil and still be too cold for a bath, and if I continued that further down I would get it down very near to 32 degrees, in other words, the water would be too cold to drink and yet be boiling.

The Court: Where is the freezing point in that?

The Witness: The freezing point is 32 degrees.

The Court: And that is true regardless of the pressure?

The Witness: Yes, sir.

The Court: So you could not carry the boiling point down below 32?

The Witness: No.

Water has been super-cooled by being kept in agitation, and cooled below 32 degrees, but the moment it is left quiet it would freeze. On the other hand, answering your Honor's question, if that water were subjected to such a pressure directly that it could not expand at all, it would go to a very low temperature indeed, before freezing.

For instance, scientists quite a long time ago, possibly Faraday, sealed some boiling water in a steel tube and put a plug in there and secured it tightly until it was right on top of the surface of the water, and then he began to cool this tube, he had previous placed in there an iron bullet before he closed it, and he lowered the temperature and continued to shake the tube, and he could hear that bullet making a sound in there, showing the water had not frozen, and he continued to lower that until what was then an almost unheard of temperature, and he was able to lower that temperature to possibly colder than any temperature that ever occurs naturally on earth, and then, being curious to see what was going on in there he started to unscrew the plug, which of course allowed the water to expand a little, and instantly it began to freeze, and by the time he allowed enough expansion, before he could even get the plug out—and the sound of course of the bullet was no longer audible, and when he got the plug out the water was frozen solidly and it was covered with a mass of frost on the surface and also on the surrounding tube.

Methyl Chloride boils at 10.65 degrees below zero.

I have previously pointed out that all liquids have that pecularity of boiling, and all liquids do not however boil at the same temperature. Water, as I have pointed out, boils at 212 degrees, alcohol at a considerably lower temperature, and then we have other liquids that may still be at a lower temperature; for instance, there is a refrigerant known as ethyl chloride that will boil at about 54 degrees above the atmosphere—above zero under the pressure of an atmosphere at sea level. Ethyl chloride may be familiar to your Honor as something that doctors use for a local anesthetic. Our refrigerant, methyl chloride, will boil at about 10.65 degrees below zero Fahrenheit.

The Court: I didn't get that.

The Witness: The refrigerant that we use in our system; namely, methyl chloride, boils under the present atmosphere at 10 2-3 degrees practically, 10.65 degrees to be exact, Fahrenheit, below zero. The refrigerant used by the plaintiff in this case, boils at 14 degrees above zero, in other words, set in an open dish, provided we could sit in here and watch and investigate it, we would find that it was boiling at a temperature of 14 degrees above zero.

For the further consideration of this subject, I can possibly limit this discussion to two liquids, namely, water and our own refrigerant.

The Court: Do all things, when they boil, have the bubbling that water has?

The Witness: Yes, sir.

The Court: You are talking about the actual boiling?

The Witness: Yes, the actual boiling. For instance, your Honor may have seen oil boil, or pitch, that is normally thick, but if heated enough to boil you can see it bubble. It is tenacious and until it reaches a high temperature the bubbles will gather below until it can overcome that tension of the liquid before it breaks through. Sulphuric acid in fact may be heated to the place where it is dangerous before you see a bubble come to the top, but finally the bubble will break through, and possibly cause the acid to fly. It is rather dangerous to heat it for that reason, in a test tube.

The Court: Lots of things go above 212.

The Witness: Yes, sulphuric acid is one. Pitch and tar might boil possibly at 300 degrees, and some other objects might boil at much over that.

The Court: Some solids, too?

The Witness: Yes, iron; of course that would be something where the temperature would continue to rise, but if it were subjected to enough heat it would boil. In these cases, the phenomena is the same in both instances, except with our refrigerant it is boiling at 10.65 Fahrenheit below zero and with water about 212 degrees above zero.

Boiling point is the dividing line between a liquid and a gas.

The Court: Is the change from liquid to gas always at the boiling point?

The Witness: Yes, sir.

The Court: That is the dividing line between liquid and gas?

The Witness: Yes. If your Honor will limit it to that very thing you pointed out a moment ago, that things vaporize below the boiling point. Even ice will vaporize on a cold day, ice will turn to a vapor without passing directly to water, or water in this room would evaporate, and it could be in fact very cold and still evaporate too.

The Court: That is a different process though.

The Witness: Yes—well, yes, that leads off into another discussion that does not enter here, although I have seen refrigerating systems built on that principle, but they are not involved here, and it would take quite a little explanation to cover that.

In other words, I pointed out these differences of the boiling points, a difference of about 223 degrees, and exactly the same process is going on in each instance; it is agitated when boiling, bubbles come up through it, and it must take some heat from the surrounding object. Nothing can boil without having heat, or, to use a slang expression, something that it can get hold of and cause it to boil. Of course, to boil water—and we always talk of sea level here now—although in this vicinity, around Detroit at least, it is only a fraction of a degree below 212 on account of our slight latitude, in fact it is not measurable by the average thermometer.

To boil water we must apply heat at a temperature higher than 212, obviously, as the heat would not pass to the water unless it was something higher than 212; to put it in, for instance, a flame. If water were set on an iron plate that had a temperature of only 200 degrees, the plate would be much too hot to touch it with your hands, but it would be much too cold to cause the water to boil the water would lay on it without boiling, and certainly it would not cause it to bubble, or any other indications of boiling. On the other hand, if a dish of methyl chloride were set on a block of ice even it would boil just as violently as the water would boil on the red hot stove. That is for the reason that methyl is something that will boil at nearly 11 degrees below zero, and a block of ice that had been melting would have a temperature of 32 degrees above zero, in other words, something about 43 degrees higher than would be necessary to cause the methyl to boil. The same phenomena would be present with sulphur dioxide, because while the differential is less and it would not boil so violently, nevertheless it would boil, because it boils at 14 degrees above, and the ice is 32, and in fact, carrying that further, if I would spill some of that methyl chloride on a plate that was in a room that was five or six degrees below zero it would still boil for the reason that it is hotter than the boiling point of the methyl.

Witness demonstrates action of Methyl Chloride.

I think if your Honor would be patient I would like to perform a little experiment here; I have got all the apparatus, and it is a visual demonstration of a boiling liquid at a low temperature, and shows just how it works, and I think it would be and would do as much to make your Honor understand it as any other one thing I can do.

Q. 8 Will it cause a smell or anything of that kind?

A. It depends altogether on the refrigerant. Methyl chloride is almost without odor.

Q. 9 Is it a perfectly safe demonstration?

A. Absolutely, yes.

The Court: It is about adjourning time and if we get a little odor it won't do much harm.

The Witness: No, you could dump into this room, a room of this size, several hundred pounds without it being particularly dangerous. I have here some test tubes and glass that we hooked from the hotel and a drum of methyl chloride. The liquid in this drum is heated up to the temperature of the atmosphere, on the principle of which we spoke a while ago, that heat flows into it, and it is probably just about equal to the temperature of the atmosphere.

The Court: What is that you are putting in there?

The Witness: Methyl chloride.

The Court: That will boil?

The Witness: Yes, for two reasons; first there is heat in the liquid, a certain amount of it must needs evaporate to cool the liquid in here; the heat it takes out is the heat of the liquid.

The Court: The only reason that it is not boiling in the drum is because it is confined.

The Witness: And under pressure, yes.

The Court: In other words, it is away down in the very, very deep mine now.

The Witness: That is right exactly, your Honor, that is the exact analogy.

The Court: As quick as the pressure is off it will begin to boil.

The Witness: Yes, and I am opening it now, and you see only gas coming out; but now you see the liquid begins to come, and when I get enough in the tube to show I will show you further about that. Now the tube is about half full of liquid. This is the same refrigerant we use in our machine. Now you will see bubbles arising from the liquid, and that is simply because the outside is hotter than it takes to boil the liquid. That will continue—that is a slight odor like chloroform although somewhat less sweet.

The Court: Is that expanding now?

The Witness: Well, the expansion due to the heat only of the liquid, just as water will expand, but further on in my discussion I am going to point out the term we have used, the expanding of the liquid is really not the correct term, it is an old term that crept into the refrigerating industry before I first knew of it 28 years ago, and we have held on to it. Now, that is cooling down you see until it will get down to about minus 10.65, down to its boiling point. Now you will observe that the frost is forming on the outside of the tube, and that is forming on it because the moisture in the air is being condensed on the outside of the tube, just as it is condensed on a very cold glass of water, but instead of remaining there, as you see in drops, it will freeze of course because this is so much below the temperature of plus 32; but if your Honor will note, while it is not so evident now it will soon become evident,, that that practically stops boiling for two reasons, first, when the liquid is cooled down to the temperature of which we spoke before, and then the coating of frost will form the insulator on the outside and so make a resistance for the effect of the heat of the air.

So we will not have this flying all over here I am going to pour a little of it in another tube. You will notice it boils, in fact, you can hear that sound, just like throwing water on a stove. That is boiling, and I will take only a little of it because—

The Court: Why doesn't it start to boil at once?

The Witness: It is cold now, you see, it has been cooled down, while that that came out of the drum was quite warm, but that is evaporating a little bit, although not evident. Now I am going to put some water in the glass, and that water is quite cold I presume, if there is any ice in this container, anyway.

The Court: That gas that comes off of there—

The Witness: That is going into the atmosphere.

The Court: But suppose you confine that, would it be as cold as the liquid?

The Witness: The temperature of the boiling liquid would become—if we confine this it would begin to raise a pressure, and of course the pressure would soon grow great enough to burst this thin tube, but in a pipe, or any apparatus made to confine it properly, it would continue to raise, and this would cease to boil temporarily until the body of the liquid became warmer, and then when it got warm enough to boil some more, it would boil a little more, and the pressure would keep going up until it got into a state like that in the drum, for instance, and then it would not boil any more. I just wanted to illustrate something else. This water is supposed to be colder than the room. Now, this boiling will become more violent as it is placed in the water.

The Court: What is the reason for it, because the water is warmer?

The Witness: Not normally. It happens if the water is very cold, but because the contact of the water on a pipe is much better than air alone.

The Court: It gets rid of the insulating?

Formation of frost or ice acts as an insulator.

The Witness: Yes, that is one reason, and the fact that the natural contact of water will remove it faster, that is a phenomena of water or—it is giving up heat from the water, giving up heat and flowing into the methyl chloride. This is boiling quite violently, you can see a drop of water hanging there yet, but if you watch it a moment, it will gradually turn into ice. You see it is gradually giving up its heat, and now it is almost all frozen into ice, because the heat is flowing from the water into that colder methyl, and it is, I believe, now entirely turned to ice. That ice began to form at 32, but it was gradually depressed until now it is practically the temperature of the liquid inside, which is about 10 degrees below zero.

The Court: Why doesn't it boil now?

The Witness: Because it has been cooled down until the temperature of the liquid is practically down to its boiling point, that is, 10.65 below, and while this vaporizes very slowly, if we watch it long enough we would see one bubble come up, and that vaporizes enough to cool the rest of the liquid, or if I put my hand on it, and still another reason, the ice forms an insulating coating, it obstructs the air from getting to it and causing the evaporation to go faster.

The Court: Taking the heat faster, in other words, making its surrounding surface colder when it is boiling than when it is in its present state.

The Witness: Well, yes and no.

The Court: That is the hazy part of that to me.

The Witness: If this is maintained at a constant temperature as it should be, without anything happening to it, that would accelerate the operation, it will always be practically 11 degrees below zero. Now, the rate at which heat flows into this is dependent altogether on the characteristics of the vessel surrounding it. For instance, if this were in something that formed a better insulator than this around it here it would take a long time to flow in there, and consequently it would boil very slowly indeed, but if this were put into something that was a better conductor of heat than this, for instance a very thin piece of silver, instead of the glass, silver being a very good conductor of heat, that would take up heat faster than it is taking it up now, and if I could keep that frost film from forming it would boil faster, or as I demonstrated a while ago to your Honor, put it in the water where it makes this frost film and brings heat in intimate contact with it, and it will begin to boil more violently.

The Court: It is boiling now because it is down to 12 below?

The Witness: Yes, sir. However, if I tip this tube until it comes on the glass, where the glass is warmer, you see it begins to boil again. It continues to boil now—

The Court: Now, is that cooling more rapidly when it is boiling than—

The Witness: Do you mean in the sense of taking up heat faster? Yes, it is, if that is what your Honor means.

The Court: The surrounding temperature is affecting it.

The Witness: Yes, in this case the surrounding temperature is this glass tube, and as it comes on to the glass, being warmer, therefore when the tube gets cold the boiling ceases, but you will observe it has taken the heat out of the tube so rapidly you will see the frost begin to form now on it even. I have let the liquid get away from it. You will also observe that the volume of methyl in there is getting less and less, because it is passing off in a vapor, and the little bulb of ice is still present there, and is practically the temperature of the liquid within the tube, namely nearly 11 degrees below zero.

The Court: The reason it doesn't boil

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The Boiling Point of Liquids

is because it is down to the boiling point, and it has built a wall about itself so it cannot get any more heat?

The Witness: Correct, absolutely, and there is nothing here to break through that wall. I can break through that wall by dipping into the water, or taking it in my hand and holding it.

The Court: In the meantime, however, from the standpoint of refrigeration, the tendency is to heat what is in contact with this, but at its same temperature?

The Witness: Correct. In other words, if the air is changing about this, each body of air that comes up there will be itself cooled, or, if it were enough in volume here I could have a small stream of water going by here, it would be cooled, five or ten degrees—and that is really what takes place in the refrigerating machine, and when we get to that point I will show your Honor where that occurs in the machine and just how.

I wouldn't smell of that too vigorously, your Honor, because while it takes a lot of it—

The Judge makes a personal test of the Methyl Chloride.

The Court: I was just going to see what it smells like.

The Witness: Yes, I think it smells like chloroform, that is the nearest thing I know of.

The Court: Would it have the same effect?

The Witness: If you took enough of it it would begin to be an anesthetic. I can pour out some of this. I will pour it on the floor. Chloroform would do the same only it does not boil at the low temperature that this does.

The Court: You call this what?

The Witness: This is methyl chloride and its formula is CH3Cl, meaning one atom of carbon, three atoms of hydrogen, and one atom of chlorine.

There is another point your Honor has touched on, namely the pressure-temperature relationships. We have spoken here of refrigerating liquids, and in the case of methyl chloride it is shown this liquid will boil at about 10 2-3 below zero, and we previously gave its boiling point as atmospheric pressure. As you pointed out, as the vapor would continue to be evolved, and if it were confined so it would not escape, it would eventually take a higher temperature to boil it; that same phenomena applies to water, as we spoke of before of course, and in some cases the temperature of water, instead of being 212 degrees may get very high, say 350, 400 or even higher in a case of some extremely high pressures.

I have also spoken of lowering pressures below the atmosphere. Now, if you lowered this methyl chloride to a pressure considerably below the atmosphere, instead of boiling at practically 11 degrees, it would go on down much colder, until, if it got in a vacuum of minus 7 3-4 pounds, practically, namely a pressure of about 7 3-4 pounds below the atmosphere, this same methyl chloride would now be boiling at about 40 degrees below zero and would act just as it did under the circumstances we have just observed.

The Court: That is, if you increased the pressure ?

The Witness: No, no. Imagine this methyl chloride in this tube at atmospheric pressure in the first place.

The Court: That is 11 or 12.

The Witness: Yes, sir. Now, suppose, without changing the temperature surrounding it at all, but putting it in a vessel from which the air and vapor is removed.

The Court: It would make the air rarer.

The Witness: Yes, exactly, or carry it on the mountain top.

The Court: It would boil at a lower temperature, and if you increased the pressure it would take higher than 12?

The Witness: That is absolutely right, before it would begin to boil.

The Court: That is just like water in that way.

The Witness: Yes, and just exactly like every other liquid of which I know. Now, if we can refer to our diagram here I can show just what goes on in each part of the refrigerating system. I have a chart here that I possibly ought to put on the easel.

Now, let us consider that these lower coils are full of refrigerating liquid; the machine is at rest, and everything is in the same condition you might say as exists in the drum there, the liquid is down here, the machine is stopped and the box is not cold, we are just starting it up for the first time—

The Court: And it is under pressure.

The Witness: Under pressure.

The Court: It has been already compressed in there.

The Witness: Correct.

The Court: By a pump. I expect it is pumping gas much the same as we force air into the tire of an automobile.

The Witness: Absolutely, exactly the same thing, and practically the same kind of a pump so far as the principle is concerned. Now let us presume that the valve down here is closed. In the meantime we open it. It allows the liquid to flow upwardly through this—

The Court: I got the idea that was not full of liquid, they had not compressed it hard enough to get it full; but you don't in this either.

The Witness: No.

The Court: First you get some gas?

The Witness: Yes. In fact the machine is not shipped full of liquid, because it is necessary to have liquid there for operating reasons, but let us presume there is five or six coils full of liquid, and the space above filled with gas of course.

The Court: But the pressure is as high on the gas as it is on the liquid.

The Witness: The pressure is as high on the gas as it is on the liquid, absolutely, just the same.

The Court: How much pressure do you think you had in your little tank there?

The Witness: I can tell by referring to my books. I can't carry those things readily in my mind, but it is about. I should say, 70 pounds, something like that.

The Court: Is that something like you had here?

The Witness: Just about the same.

The Court: It would give me a little idea at to how it spurts out there.

The Witness: Yes; let us say it was 68 degrees in this room, then that pressure would be about 68 3-10 pounds in the drum.

The Court: If you lifted that bottom side up would not the liquid have gushed out?

The Witness: I did have it bottom side up, so far as the liquid covering this end of the tube was concerned.

The Court: I didn't say what I meant to say. Suppose you hold it right side up and open it, would anything more than gas have come out of there?

The Witness: No, sir, just gas, and if I left it open long enough—let me have that wrench.

A case where bubbles do not signify boiling.

The Court: The same as you open some kind of bottles and they almost empty themselves.

The Witness. Correct, but that is not the same principle exactly, the gas in that case, I can speak of a certain forbidden beverage I have seen on the other side of the world.

The Court: Champagne?

The Witness: Yes, sir; and pop is a similar illustration, or carbonic acid gas.

The Court: But that is not the boiling principle at all.

The Witness: No, not at all, that is mechanical. Now you will observe that you can notice that drum is getting cooler, you can possibly feel it getting cooler down low?

The Court: Why doesn't it get cool at the top?

The Witness: It will gradually because the gas coming off the surface of the liquid will be—the temperature from which it is coming from the liquid—do you feel it getting cooler?

The Court: Yes, I was trying to see which was getting cooler fastest, the bottom or the top.

The Witness: I think it's about the same.

The Court: Yes, as near as I can judge. I get the idea.

The Witness: Now you observe that is quite cold there now.

The Court: Yes. So you don't get any liquid gushing out of the top of this coil here on the illustration?

The Witness: No, not at all.

The Court: So the horizontal position of that then is of some importance?

The Witness: Oh yes.

The Court: You would not want that liquid running out.

The Witness: No, not out of the top, at least, we have to keep this liquid.

I am wondering if the plaintiff's exhibit of our apparatus is not a better one to illustrate this. I think it is, and if they have no objection I will be glad to use it to illustrate.

Mr. Cooper: I thought all along that our evidence was better than yours in this case.

The Witness: Well, I certainly do concede your drawing is, at least.

As the liquid comes out through the valve that is now open it rises by reason of the pressure on top of here, just as I would pump air pressure on top of water in the tank, forcing the liquid up here, the liquid passing through the strainer and comes to the expansion valve.

The Court: As a liquid?

The Witness: As a liquid.

The Court: It pumps out of the bottom here?

Action of the expansion valve.

The Witness: Well we won't presume it is pumped out, but forced out, just as you would put a pressure on top of the water in a vessel and so force the liquid out. It comes in through this portion of the valve, and this valve is so constructed that it will require a certain predetermined pressure on this side of it before it will close, in other words, under any condition where the pressure on this side of the valve is lower than that predetermined pressure, the valve will remain open. And by the way, I want to point out now that that is a very small orifice indeed; and when the valve opens, it opens only a little at a time, and you can hear it when it opens if you listen closely because an exceedingly small amount of liquid passes through that very small opening. That is this valve right here. We are starting from the first, when this tank is full of a warm solution.

The Court: It is full at the bottom with liquid and at the top with gas.

The Witness: Yes, under pressure of about 50 pounds.

The Court: And the liquid is forced out from the bottom up through this part in the expansion valve.

The Witness: Yes, and as I said before, this valve is really misnamed, it is not an expansion valve, because really no such thing as an immediate so-called expansion of the liquid takes place, rather it is a conventional reducing valve such as you would have on a boiler where you have a high temperature of steam, and you desire to lower it to the lower pressure for certain processes.

The Court: Isn't that arranged so that the tension represents the difference and keeps a uniform difference in pressure, so that the pressure on the liquid side of it is always a certain amount higher than the pressure on the gas side of it?

The Witness: Correct, and that is predetermined by an adjusting nut that tightens up this spring or loosens the tension on that spring.

The Court: About how much difference in pounds now, measured by—

The Witness: We carry six pounds.

The Court: The difference, I take it, is represented by the tension there is on the spring.

The Witness: Yes, that runs about six pounds per square inch, is carried in the coil, and if it is coming through it at 60 there is a difference then of 54 pounds between the high side coming in and the low side going out. The liquid flows down in this coil, and let us say this tank is full of brine or some other fluid that is warmer than—

The Court: It doesn't go spurting into gas?

The Witness: No, especially not after this gets cool a little bit. You observed we opened that drum and a small amount of something came out first, and that was gas. Then a stream of liquid later began to flow. It flows into this coil, and the coil is heated by the heat flowing from the brine, and that in turn changes this liquid into a vapor, and a certain amount of liquid stays in these coils, just as I showed it lying in the tube.

The Court: And that begins to boil at six pounds pressure.

The Witness: Under low pressure, yes, and that boiling temperature is in this case about five or six degrees above zero. Now it turns to a vapor and passes off through the pipe, coming down through the pipe here, down to the suction side of the compressor, always at six pounds.

The Court: Six pounds.

The Witness: Now, this gas having gone into this so-caled orifice, that part of the cycle described before where this temperature has gone down as low as possible in the heat scale—

The Court: It boils unless it is down to 12?

The Witness: Yes.

The Court: Sometimes it doesn't appear to boil then either.

The Witness. Yes, just as you see it in the tube, they show it, the same condition takes place here as you observe it in the tube, except the temperature is different because it is under a different pressure than the temperature of the atmosphere, it is about 6 pounds above. Now, in flowing into the suction side of this, just as air flows into the air pump, we are compressing, the gas is compressed, and being compressed it does that of which I spoke of having a pump in the basement to hoist water; this, let us say, hoists heat temporarily.

Mr. Sessions, earlier in his discussion, pointed out that the gas was like a sponge that picked up heat, and I consider that is a good analogy; the gas all along here has been as a sponge, it picked up the heat, and now comes to a place where you are going to squeeze that sponge—

The Court: Make it hotter?

The Witness: Yes, very much hotter, and the gas goes up here in the condenser, and then is exposed to the cold coils, made cold by water or a stream of air led to it by a fan, or merely standing in the air.

The Court: The air temperature is cold as compared to—

The Witness: As compared to the heat coming out of this compressor, yes.

The Court: How hot does that get there?

The Witness: It will be a little too warm to put your hand on, about 125 I should say, because certain of the heat is radiated.

The Court: But when it gets in here it is comparatively cold?

The Witness: Yes, sir.

The Court: It has got warmer than you want it, it has got warmer than 12?

The Witness: Yes, although it would be possible to carry on the refrigeration and still have the gas only at 12, providing the atmospheric pressure was carried, because there is a change beginning right there, that is not necessarily heated, that

(Continued on page 30)

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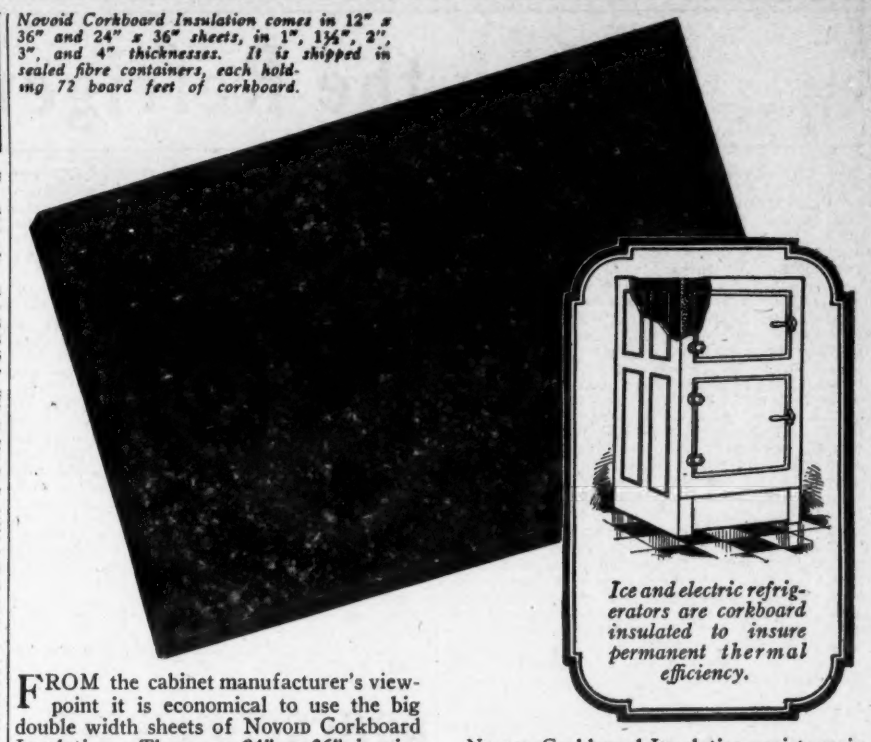

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How the Refrigerant is Used to Transfer Heat

has not necessarily heated the liquid—nevertheless it has been absorbed, it has been absorbing the latent heat, that is, the liquid is boiling without being lowered or raised in temperature, just as I spoke of the tea kettle on the stove, the gas flame is under it, and if you had a thermometer on it and it was at sea level, that kettle, the water in the kettle would never get warmer than 212, but the vapor evolved would continue to pass away, and that is evidence that something has happened to the water to change its form, and that is has absorbed latent heat, and if the gas or steam that passes off from it is subjected to another influence in going off, it retains the same temperature as the liquid does from which it was evolved. We call that the saturation temperature. If no other influence was brought to bear on it at 212 degrees it would not become lower than 212 degrees and would not rise above that; however, it is of course subject to other influences just as this is. For instance, if this were a large refrigerating plant and we were handling a liquid at 6 degrees above zero, as we often do in the large plants, this pipe would be covered with frost and continue to be right down to the compressor, and we possibly would have a thermometer in there—

The Court: It stays colder than 32?

The Witness: Yes, sir, it would be down to very near its saturation temperature. Any heat above 6 degrees coming out of there is considered super heat, and in that machine, either the one submitted by ourselves or the plaintiff, the gas is clearly super heated, because if this machine was operating you would find this pipe shows no indication of frost. That is not a false efficiency, but we submit to that slight loss of efficiency in order to serve convenience; in other words, it would be inconvenient to have this pipe frost covered to melt off and run over on the floor at the end of each cycle.

The Court: How did you avoid that?

The Witness: By so constructing this coil, and of such size that the vapor that is evolved here at 6 degrees actually is super heated as it comes out. The first superheating begins in the tank itself, and suppose this is 20 degrees, the brine surrounding it here, and the gas that comes out here is 6 degrees, it is going to be heated something up close to 20 at least.

Q. 10 The brine is going to give off some heat?

A. Yes, in other words it is giving it back to the gas a little. The pipe coming out of here is bare, and being thin the heat goes into the pipe very rapidly, and it passes through air that is maybe 70 or 80 degrees, and it is very rapidly superheated until it gets back here to 40 or 50 or 60 degrees. That, briefly, is a description of the cycle that goes on. Well, I have not quite finished that. This gas goes here, and is squeezed and going here goes back to a liquid again. This has completed the cycle, and this goes over and over again.

Q. 11 How hot does it get there?

A. Well, that of course would depend—I should say that comes out of there about 10 or 15 degrees of the air temperature—

The Court: That is when it goes into the pump.

The Witness: No, where it comes out of the condenser, now, where it has been condensed and cooled. In other words, because heat always flows down hill in the temperature scale, and because the air is 60 degrees ,this is much hotter, let us say 125 or 130 or even higher, and it flows down as near as it can to the air temperature, and it will never quite reach the air temperature because the nearer it gets to it the slower the flow. In other words, I will illustrate that a little better. If I had water flowing out of a tank and that tank was two feet above the place where the water was delivered, and the altitude of the water was maintained the same, in other words, flows in as fast as it flows out, and that pipe remained at constant size, the water would flow out of that tank at a certain rate. If I raised that tank higher and maintained all the conditions the water would flow out faster; finally if I took it on the roof it would come out much faster because of the difference in pressure at the high altitude.

Now, the very same thing applies as far as heat is concerned, as long as we keep in mind that the heat is flowing in the heat scale only and not in the altitude scale.

The Court: A gas or liquid, either one, heated to 120, will give off heat faster than—to some other surrounding body than cold—

The Witness: Correct.

The Court: And that is the advantage you get by condensing and raising to a high temperature.

The Witness: Yes.

The Court: You make it easy to give off the heat?

More heat is produced than is taken out of the box. The difference represents a loss in efficiency.

The Witness: That is absolutely right. Now, one more point. Your Honor asked the question if there was more heat evolved here than was taken up here—there is a certain amount of heat that goes into the coil by reason of the conditions that go on here, and when this comes down and is subjected to work here, a certain part of that work evidences its presence by heat, in other words, this gas is heated actually; if you could measure the B. T. U.'s in there, the volume of heat, it would be greater here than here. In other words a condenser always throws and rejects more heat than was taken here.

The Court: It is a little loss, you lose some in transmitting the power, or in what?

The Witness: Well, to coin a term, as Mr. Sessions spoke of "work," could be translated directly into heat. In other words, at the rate of 778 B. T. U.'s to the foot pound, or vice versa, 778 foot pounds to the B. T. U., this certain amount of work has been done right here, and that work that is taken up with this motor is not realized in useful return here, but say about 20 per cent of it.

The Court: About 20 per cent efficient.

The Witness: No, about 20 per cent loss.

The Court: About 80 per cent efficient?

The Witness: Yes. We cannot realize that in a small machine of this kind, but a certain amount of that work goes in here until there is about 20 per cent, allowing a little leeway now on that figure of 20 per cent that much more heat goes in here and must be evolved from this condenser. Heat just does not appear from no place, but that 20 per cent is work that the motor has done, and used electricity in doing, while the other heat has come in from the universe.

The Court: You have to take out more heat while it is on the condenser than you are able—

The Witness: Than you are able to get from here. In a conclusion of that particular point your Honor will see—let us go to the water melon again as an analogy that is put into the refrigerator, and say that the melon is 90 degrees, in the first place, and you will see that the heat has been passed from that into the air surrounding it in the refrigerator, the gas passes through the tank into the liquid brine that is inside, into the coil containing the refrigerating liquid, and out of the coil, and heat is being carried by a vehicle, that is the gas goes down the compressor where it is hoisted up in the heat scale and finally dumped into the atmosphere outside from which it came in the first place. That is the cycle.

Mr. Cooper: If that phase of it is over with we would like to put it off until morning.

(Adjournment to Wednesday, March 20, 1929, 9:30 o'clock A. M.)

PROCEEDINGS OF THE THIRD DAY OF THE TRIAL

Wednesday, March 20, 1929.
9:30 A. M.

Court convened pursuant to adjournment.

Parties present as before.

Harry C. Hayes was thereupon recalled as a witness on behalf of the defendant, and having been previously duly sworn, testified further as follows:

Direct Examination (Continued)

By Mr. Frye:

The Witness: Last evening as I finished explaining that part of the talk I made the statement I just wanted to be sure your Honor understood when you asked about the efficiency of the outfit, I did not mean to state that the particular efficiency of which I spoke was peculiar only to the Absopure machine, that is to any machine, of course.

Q. 12 What was that efficiency?

A. Well, I spoke of the difference between the work input of the motor, translated into heat, and the actual heat that would appear at the condenser.

Q. 13 I believe you used the percentage of 80 per cent, didn't you?

A. Well, 20 per cent loss, or 20 per cent more heat rejected at the condenser than is taken in at the evaporator.

Q. 14 Now, is that more aggravated in the case of air cooled machines?

A. No, that would be just exactly the same thing in any case.

Q. 15 You are talking of air cooled machines?

Development of a reliable thermostat has been a big contribution to the success of the domestic refrigerator.

A. Air cooled or water cooled either. There was something else to which I would like to call your Honor's further attention, and that is the thermostat, that we did not speak of yesterday, has become, of course, a very necessary thing to the household machine, because a householder cannot, of course, turn on the machine and then stay around until the box needs to be shut off because of getting too cold, and then turn it on again, but in the very early days that is exactly what they had to do, they were entirely hand controlled machines. Now the industry has a thermostat and other things doing that automatically, automatic control of those items, and that possibly has had as much to do, or more to do than any other one thing of which we can think that has contributed to the success of the household machine, its uniform use. The thermostat that we use is not our own. Successfully operating thermostats are comparatively a new thing.

The Court: Are they made in the usual way?

The Witness: No, this works on the principal of expansion, it is filled with the volatile liquid, and the element that goes into the brine tank is also filled with the same volatile liquid, and when the brine hits it that liquid expands, closes the switch and that switch has a mercury tube on it as its active element, and turns on the motor current, and when the brine gets cold enough that same liquid contracts and turns the switch the other way.

The Court: Do you have any trouble with the arcing?

The Witness: No, it is in a tube with either a vacuum, or filled with a neutral gas, an inert, inactive gas, such as nitrogen.

I have a drawing over there at my table; I will get that; it is not mounted, I am sorry to say. I just had to bring this from our school, it is diagrammatic, it is very old.

This drawing, your Honor, is one that we use in our school down there, purely diagrammatic, but was meant to show the condition of the refringerant in all parts of the system, and I thought that possibly in view of our talk of yesterday I could make it a little plainer by showing it in this fashion.

If we start off with the gas coming through the compressor, we show the gas in the situation to be pink, we show the liquid to be red; where the liquid goes to the gas a little bit, it rather changes the colors, one shade to the other.

Starting at this point, where the gas is on the way from the evaporator into the compressor—

The Court: About six pounds pressure?

The Witness: About six pounds pressure, yes; at six pounds pressure. I should have said the gas—well, I see there is no differentiation here in the gas under high pressure or under low; it is the same color.

The Court: Show me where it is changed in the pressure.

The Witness: Right here in the compressor.

The Court: Trace that gas.

The Witness: All right. Beginning at the compressor, flowing in, the pink gas, as you see, as shown pink here, comes into the crank case. This represents oil down here (indicating).

The Court: Still at low pressure?

The Witness: Yes, still at low pressure here.

Now, there is an opening through the piston, and as the piston comes down, leaving what would become a partial vacuum in the cylinder above, the space above the piston in the cylinder is filled with the gas. The compressor now drives it, shoves it, through the discharge valve and into the upper part of the compressor, right under that cylinder head. Now, that gas now has come to high pressure.

The Court: What, about?

The Witness: Well, let us say a hundred pounds, something like that. It varies, depending on the temperature of the atmosphere outside.

It now proceeds along at 100 pounds pressure per square inch until it reaches the condenser, and here it begins to be subjected to the air. In fact, even here, this tube passing through the air, of course, being higher than the temperature of the atmosphere, is cooled somewhat. Now, it comes along here, and the first thing that happens—

The Court: You said it is subjected to the air. You mean it is in tubes that are subjected to the air?

The Witness: Yes, that is what I meant. Here the gas is cooled by the contact of the atmosphere outside of the tubes. It first loses some temperature, and then it comes to a point where it begins to condense. This gas going out here from 140 to 150 degrees, that is first of all cooled down to the point where condensation will begin at that pressure.

The Court: Now, is that the same as boiling point, when it goes back?

The Witness: No, I would call it a condensation. Oh, you mean it is the same temperature?

The Court: Is condensing temperature the same as boiling temperature?

The Witness: Yes, sir; at the same pressure, exactly.

The Court: That is crossing the equinox in the other direction?

The Witness: Yes, that is it exactly. Now, the condensation after the gas is cooled, which will take place in the few top coils, condensation will begin more gradually at first, and increasing until we get down to the bottom here, we will have practically solid liquid in this coil. The bottom part of this coil acts as a receiver.

The Court: Pressure, however, being the same?

The Witness: Pressure being just exactly the same. Now, it flows through a valve that has no function except just to shut off or turn on in case it is wished to isolate part of the machine for repairing or anything of that kind, comes on up here in liquid form—

The Court: Under about a hundred pounds pressure.

Function of the strainer

The Witness: Under about 100 pounds pressure; until it reaches a point where there is a strainer in the line. That strainer has no function except to catch any foreign matter that might be in the liquid and keep it out of the expansion valve, because that orifice through the expansion valve is very small indeed, and anything coming through there would block it up and stop it working satisfactorily.

The Court: How small?

The Witness: Well, that thing does not lift off of the seat of this particular type of valve much more than a thousandth or two thousandths of an inch.

The Court: The reason being to keep the pressure high behind it, and to go ahead?

The Witness: That is it exactly. It is a reducing valve, in other words.

Now, the liquid flows through here—I am not so sure that this coil is exactly the same coil shown in the exhibit there. That is, the pipe may come in above here, while it may come below some place else;

(Continued on page 31)

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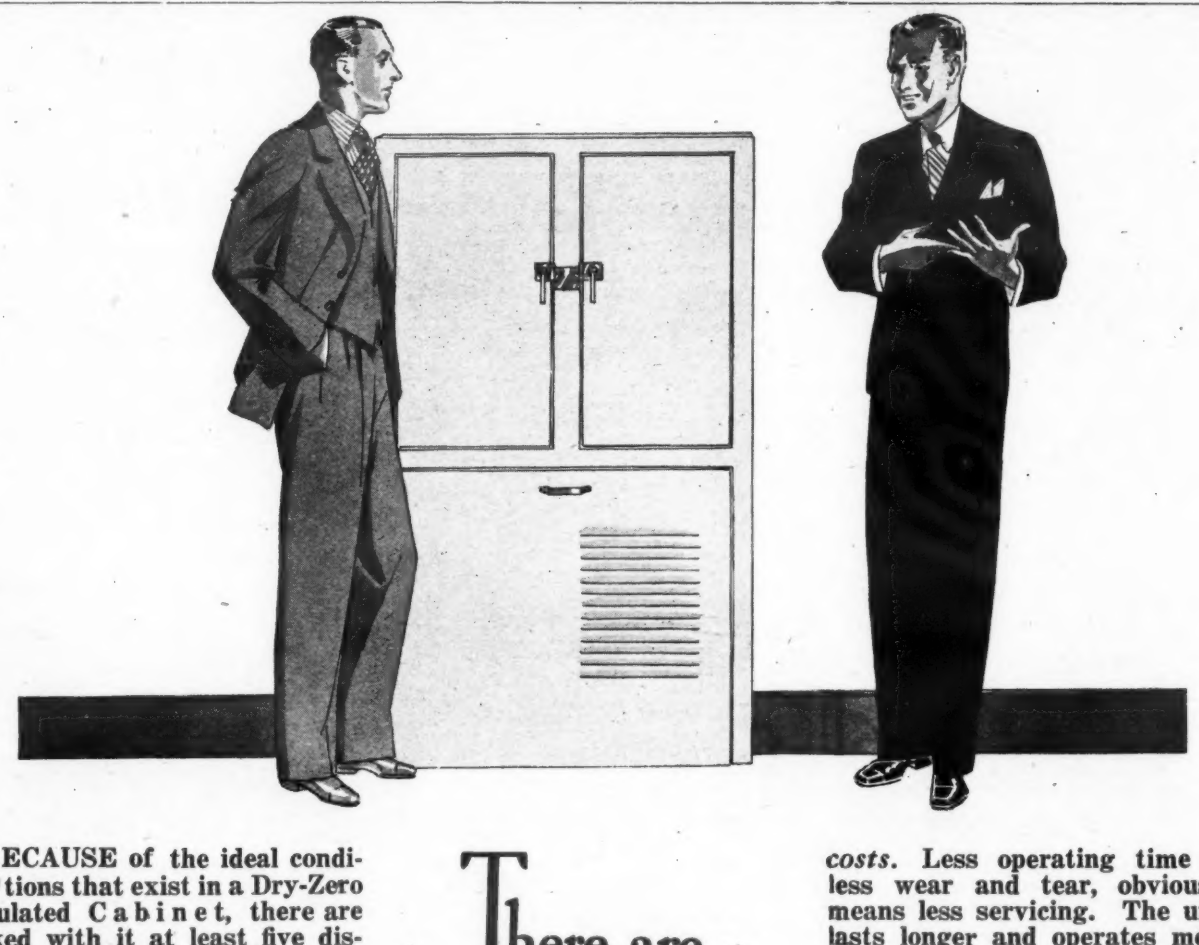

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but the purpose is exactly the same, and there is no difference so far as the thermal result is concerned.

The Court: This is liquid?

The Witness: This is liquid, comes into the coil. In fact, that liquid immediately after passing the expansion valve is subject to a pressure of, say, only about six pounds above atmosphere. Now, under that condition, of course, the first thing that happens, the liquid begins to boil, and a portion of it is immediately boiled off without regard to heating influences around it, merely by the heat that is contained in the liquid itself.

Your Honor understands, of course, coming out of this condenser that is warm, it may have a temperature, let us say, of 80 degrees, just to be fixing a temperature; and yet it finds itself under a pressure where it is willing to boil at a temperature of about five or six degrees above zero.

Consequently, there is some of that liquid immediately evaporates in order to cool the rest of the liquid. It does that by its own internal heat, just as if hot water were heated in a big boiler up to a temperature above what water would boil in the atmosphere, and a valve would open releasing water outside; you would observe that some of the water would flash into steam immediately, it would go right to steam.

The Court: And cool the rest of it?

The Witness: To cool the rest of it—that is exactly the case.

Now, that is exactly what begins to happen in this pipe, consequently, in the machine under operation you will observe frost on the outside of this pipe, in other words, the liquid is being cooled now and also heat is flowing in from the outside, just as your Honor observed on the test tube, and the liquid is now cooled down to about five or six degrees above zero.

That process is going on in here, also, of course.

The Court: Which is a refrigerating temperature for ordinary—

The Witness: Yes, sir, that is it exactly. In other words, it is brine in here maybe about 20 degrees, and the temperature inside the pipe about 6 degrees, so you can see that there is a 14 degree differential between the brine temperature and the temperature within the pipe.

Now, the refrigeration is going on in here, and is gradually turning the liquid that is dumped in here into a vapor.

Now, that vapor passes out of the machine or out of the brine tank, presumably all vapor now, no more liquid left, just in the same shape that a kettle will dry on the stove, and the gas being pulled along by the machine.

The Court: Low temperature, however, has picked up what heat it got out of the refrigerator—

The Witness: Correct, and could be at the same temperature at which it is introduced, namely, 6 degrees, and still be effective, but it has changed its state from a liquid to a vapor.

Now, as a matter of fact, as I explained to your Honor, there is some superheating that goes on in here, so that this coil coming back to the machine is really considerably above 32 degrees, but that is caused by air on the pipe outside.

The Court: That is where you get some of your ten per cent loss, that is where it goes?

The Witness: Some of the loss, yes. Now, the plaintiff's machine evaporator does not work on this exact principle, however. I have a drawing here, I believe. It is a drawing of the Frigidaire evaporator. It is on a card about so big (indicating).

The Court: It seems to me this is the thermostat in the wrong place.

The Witness: No, that is the pressure gauge, your Honor, just to show the temperature.

The Court: Where have you got your thermostat?

Thermostat is located in the brine tank and set to operate at a lower temperature than that in the food compartment.

The Witness: The thermostat is in the brine tank. It does not show it in this drawing, but the plaintiff's exhibit over there does show it and the element of thermostat is in the brine tank, and the thermostat switch itself happens to be installed in the base of the box, or kept at another convenient place.

The Court: Do you actually have that pressure gauge?

The Witness: No, not as a rule on the machine we send out, but they are probably put on there for testing purposes, and it is put on here because we wanted to have the men understand that about six or seven pounds was required but that does not go on the average machine that we send out.

Now, this drawing is of a characteristic evaporator of the plaintiff's type, and is a drawing of the type of machine that was being made at the time this suit was brought, and in essential details it is just like the one over there.

The Court: If you have your thermostat in the brine, your thermostat is always showing it colder that it actually is, lower temperature than it actually is—in the refrigerator.

The Witness: Oh, yes, in the refrigerator.

The Court: You don't have that thermostat in—

The Witness: In the air of the ice box?

The Court: Yes.

The Witness: No. We have designed these surfaces so that with the box of a certain value of insulation and so forth, so that it is just about correctly balanced to maintain a temperature somewhere between 38 and 45 in the refrigerator. It will vary a little bit with the weather.

The Court: Is the temperature of the entire mass of brine pretty uniform, or do you get—

The Witness: Well, there would be some stratification, because if you cool any liquid, of course, it is rather reluctant to circulate, but that is not very much, because the coils are more or less scattered throughout the entire body of the brine, but generally, the brine would be colder at the bottom than up at the top. The top is the warmest place. That is for two reasons: First of all, the reluctance of the brine itself to circulate, and the next reason, because the warmer air from the refrigerator passes over this evaporator first, over the brine tank first, and of course, as it goes down, the air is cooled, and it drops off the bottom that is coldest.

The Court: Where do you take the thermostatic temperature?

The Witness: Oh just about half way down. Now, in the evaporator in question, which is, of course, radically different, as your Honor will see, from the one that we use, there is a boiler—

The Court: Which is this?

The Witness: This is the plaintiff's.

The Court: This is the plaintiff's?

The Witness: Yes.

The Court: This is the defendant's?

The Witness: Yes, this is ours, the defendant's here, and this is a model of the plaintiff's B 5-2 Frigidaire that was made at the time this suit was brought. This is a boiler that has sometimes been called an evaporator, properly so, and works on a different principle altogether. This works on a principle that was first brought out, so far as I know, by a man named Krebs in the United States patent that is cited in this answer. Such patent was filed or granted in 1890. I have the number of it upstairs, and if we can find that patent, which I imagine we can, I would like to show it to your Honor to show you the general similarity.

The principle of this is, as I speak of, a little bit different, the liquid coming in from here under the pressure, through the expansion valve about 100 pounds pressure; if they were using methyl chloride, but this would work also with methyl chloride, the refrigerant being in here through a comparatively small opening.

The Court: A cylinder valve.

The Judge quickly understands the operation of a float valve.

The Witness: The same principle as a valve but somewhat larger. Now, you have a valve pin that goes up here and closes this opening; that is at the present shown with the valve open. Now, when the operation begins the liquid flows in here past this valve that is open, and what opens it is a float that will drop.

The Court: Like a toilet float?

The Witness: Correct, the same principle. The refrigerant flows in here, flows up the tubes, and this is a side view of it, an end view would look something like this as shown in the plaintiff's exhibit. Now, the liquid comes in, fills these tubes.

The Court: Are you holding that horizontally?

The Witness: Yes, that is just the way it is there. If you wish I could show you on the plaintiff's exhibit.

The Court: Yes, let us have it that way.

Mr. Cooper (referring to plaintiff's exhibit): This diagram of yours only shows the cooling coils, Mr. Hayes.

The Witness: Yes, only the cooling coils. It was not intended to show the trays, although—

Mr. Cooper: But it does not show the condenser and the motor and all that?

The Witness: Oh, no, not at all, just the cooling coil alone.

Now, the liquid flows in here, fills the coils up and continues to flow in until a sufficient amount is there to give the float buoyancy.

The Court: The liquid?

The Witness: The liquid.

The Court: It does not go into gas here?

The Witness: Well, some of it begins to go into vapor as soon as it comes in because of the situation I have explained, that heat comes very rapidly, and outside of the starting of the machine that has not been freezing at all, and there is no refrigerant in this part, it comes into an empty space, and there is some flashing into vapor, but in a very few minutes, indeed, this tank is full of liquid; it begins to boil even from the first drop that comes in, of course.

The Court: In the defendant's machine the coils are only the lower coils filled, and in the plaintiff's machine the coils are entirely filled.

The Witness: Yes, in the defendant's machine only the lower coils are filled and in this the coils and part of the—this part here also.

The Court: That is a little tank at the top.

The Witness: Yes, sir, or if we speak of it as a boiler. In fact there is a boiler made by the Erie City Iron Works, made possibly 20 years ago or more, that looks like this, it has a drum on the bottom, and such a boiler is also used at the Tivoli Brewing Company in Detroit, installed about 1910, I should say.

The Court: Whether or not the tubes are entirely filled and the gas in the tank connected at the top, or whether the tubes are partly filled with liquid and the top of the tubes filled with gas would make no difference with the principle of it, as I understand it.

Flooded system requires a greater amount of the refrigerant.

The Witness: Not a great deal of difference with the principle, but as a matter of fact in operation this is always filled with liquid—pardon me, was your Honor pointing out the difference between ours and the other?

The Court: Yes, yours has no tank at the top at all.

The Witness: Correct.

The Court: But I don't see any difference in the theory or principle.

The Witness: Not a great deal except there is enough difference in it for Krebs to get a patent on it, and it is very good and widely used in the industry, even in the big equipment for certain purposes.

The Court: It makes it easy to regulate the valve, I would say.

The Witness: Well, we know the liquid is always carried at a certain definite height in here. A system like this, of course, requires considerably more liquid. For instance, in this if it were taken in terms of methyl chloride, which is somewhat lighter than sulphur dioxide, we would probably have pretty close to three or three and a half pounds of liquid in this system, while with the one we actually have over there we have only about somewhere about between 13 and 15 ounces of liquid.

Methyl chloride more expensive than sulphur dioxide.

The Court: Is it expensive stuff?

The Witness: Methyl chloride is worth, in large quantities, about 60 cents a pound, and sulphur dioxide, as I understand in fair large quantities, about 6 cents a pound, so methyl chloride is worth about ten times as much.

The Court: In other words, with the kind of stuff you use the volume of it is some item, while with the kind they use—

The Witness: Yes, in other words with the kind of refrigerant in this would probably cost less than our refrigerant there.

After this thing is full the liquid—after this is full of liquid, the float valve shuts off and after that liquid is in through here, as the other liquid in here goes off into vapor, as in a steam boiler, it is in steam, and passes off to the compressor, and new liquid comes in to fill up the place made vacant by the vaporization of the liquid. This vapor passing off from here goes out through this line, which is a suction line. Another peculiarity of this, oil and sulphur dioxide do not mix to any appreciable extent, and consequently the oil floats on the top, and the plaintiff has made certain arrangements here to skim off the oil along with the gas that comes up.

The Court: From the grease, from greasing the thing is that?

The Witness: Well, there is oil to lubricate, it is not a grease but oil, and it must have certain characteristics to be used particularly with a refrigerant to be neutral to the reaction of sulphur dioxide, and also free from moisture, and it must stand a sufficiently low temperature not to congeal in this part of the system, and to keep this from filling up, because the oil has a rather definite relationship—

The Court: Where does it go to?

The Witness: Back into the compressor, and into the crank case where it again serves its purpose. Oil serves no useful purpose here in this system.

Mr. Cooper: The oil circulates with the refrigerant too.

The Witness: Yes, in that they are alike, and the oil is constant the same as the refrigerant.

Q. 16 The oil always remains a liquid unless it is—

The Court: There is no chance for it to escape?

Reference to Frigidaire's new "Cold Control."

The Witness: Oh, no, no, that is tight. We forgot to look at the thermostat, but your Honor understands it, I imagine.

The Court: That is, theirs is the same as yours?

The Witness: No, the one the plaintiff has on that machine right now is one I believe that has recently been quite widely advertised and as far as my information goes it is quite new, but it serves generally, at least the one did that was on there at the time this suit was filed, serves exactly the same purpose.

The Court: Where do they take their temperature, from the brine?

(Continued on Page 32)

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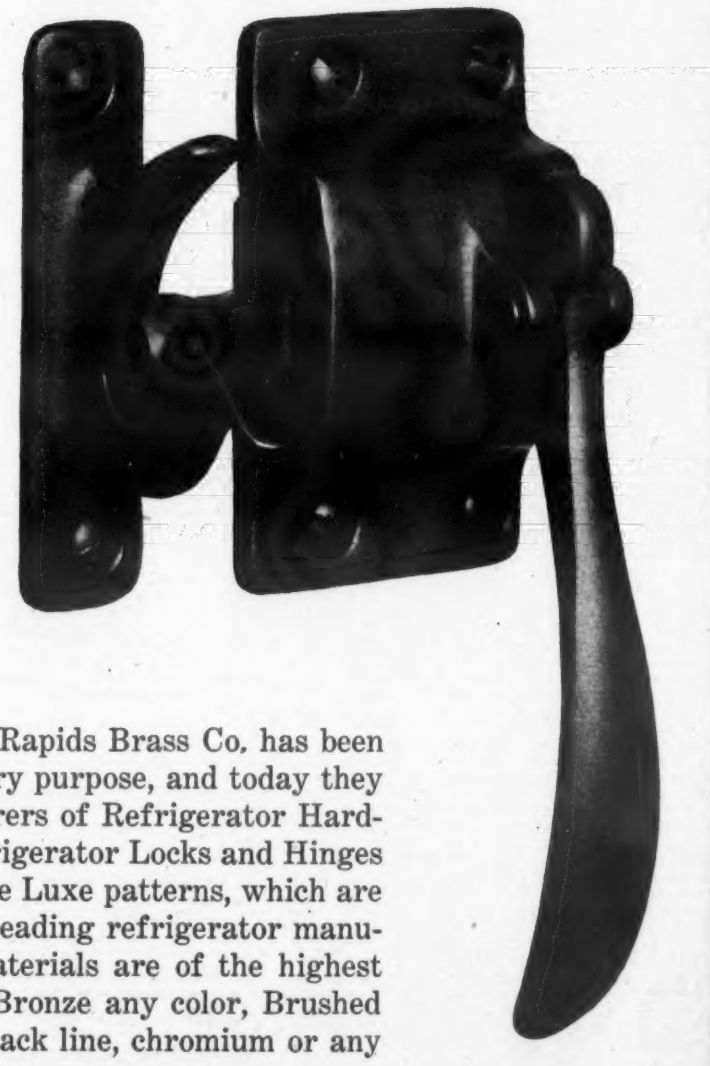

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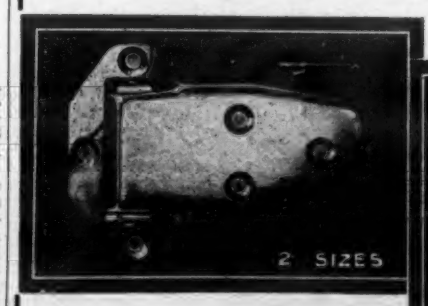
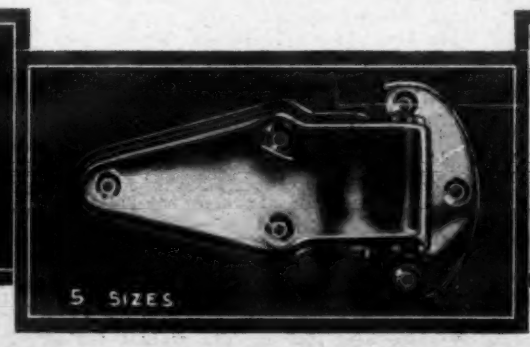
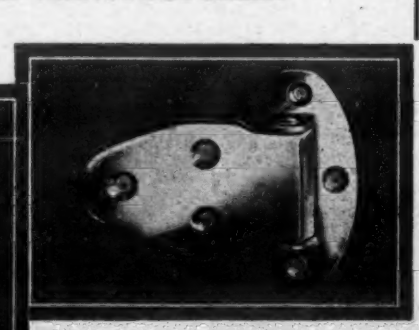






Pressure-Temperature Controls

Operation of the pressure method control.

The Witness: Their arrangement is regulated by pressure, in other words when the pressure in that boiler is reduced to a certain place by reason of the compressor drawing out the vapor which is evolved under the heating of the box, the pressure gradually lowers, in other words their outfit is not a constant pressure outfit as is ours. When the pressure is lowered by reason of the large compressor, that is I mean large in comparison to the heat that can come into that evaporator through the walls, the pressure is lowered, and as it lowers enough there is an instrument there, a pressure regulator or a pressure stop, I believe it is called, that stops the motor. Now after being stopped of course heat continues to leak in through the evaporator, just as if the machine were running, and gradually the pressure comes up because the passage is closed then, there is no drawing away, and of course the higher the pressure raises in there the slower the heat leaks in, and they have that arranged to turn on again after it rises to about 10 or 15 pounds, and the compressor again starts drawing the vapors out of that drum up above there, and the cycle is repeated; in other words, the machine stops, heat continues to leak in, pressure raises by reason of that fact, and when it raises to a predetermined pressure the compressor starts again, because, as I pointed out before, it is large enough to take away vapors a little faster than they are formed, the pressure is gradually lowered and in some instances that cycle, I imagine would run 6 or 8 minutes, or something like that; it takes about six or eight minutes, depending of course on the temperature outside, and how many times it is opened and shut, and so forth.

The Court: The pressure is indirectly—bears a direct relation to temperature.

The Witness: Absolutely correct, that is right, your Honor.

The Court: So they can just as well take it on pressure as off the temperature?

The Witness: Yes sir, just as well, and that is the way they choose to do it.

Now we have spoken about the principle of this machine and I would like to point out to your Honor that our principle has absolutely nothing new in it at all over the first refrigerating machine that was ever built of which we have a record, and which used a compression system.

Q. 17 The question originally asked was as to a comparison between the principles of the old and new, only in the sense as they were large and small units. Now let us get the answer to the idea as to whether or not the principle of refrigeration in both the large and small was known prior to the patents in suit. Now that question will lead us in this way; when did you, as an experienced engineer in refrigeration work, learn of the principle which is used in both of the machines in Court?

Mr. Cooper: You mean the refrigerating cycle?

The Court: When did he first learn of it?

Mr. Cooper: Why, there is no dispute about that, I stated in my opening statement that there was nothing new about the refrigeration cycle, there is nothing to dispute about in that. If your Honor please, is it necessary to go into this when it is not in dispute?

The Judge is an interested and willing student.

The Court: I will permit it. It may soak into the Court at least—you gentlemen all know about it, and I have to take some time, and if you want to go over it on both sides I am willing.

The Witness: I think I first began to learn about it about 1900, it certainly must have been called to my attention when I first went to work; at least, I certainly know I knew about it by the year 1902.

Q. 18 At the very start of your career in refrigeration you learned of the refrigerating cycle and only gradually became acquainted with the text books, literature, and publications, and so forth?

A. Yes, sir.

Q. 19 Now without regard to the patents at this stage, I wish you would briefly tell his Honor what you might call common knowledge of mechanical engineers of refrigeration of the development of the refrigeration industry, without trying to direct you by question and question, we wish you would show, if it is the fact, that the mechanical refrigeration business gradually became to be manufactured in smaller capacity units per day, with or without a change in construction. We do not want you to spend the day on it, or anything like that, but if you can tell us in a reasonably short time the train of development from the time you entered the field to the present day, I believe it would be helpful. Now, can you answer that in a reasonably short time?

A. Just from the time I entered the field?

Q. 20 Well, I want you to tell the Court of the development as I have expressed it, of the common knowledge of engineers. Do not try to tell of special work on your part, but what was generally known. There are a lot of other engineers here, and we would like to have it checked.

A. Of course the first machine built in the world obviously was a small machine because the inventor, of course, did not immediately build a great refrigerating machine like we have in cold storage plants and large industrial affairs. It, of course, was of necessity a small machine. Through those years following that there was of course a great deal of work done toward the development of other machines. That came about of course years before I was born, years before there were many plants built, and machines were running, some large and some small. Refrigeration was a pretty well known and established fact at the time I was born. It did not have of course the facilities that it has now, but it was used to a great extent in breweries and the meat packing industry and so forth. Sulphur dioxide, of course, was a well known thing years before I was born, in fact that was brought to the attention of the world by Pictet in 1870. While Pictet was a professor of physics at the University of Geneva, he was successful in liquefying sulphur dioxide and called it to the attention of the world and built machines using sulphur dioxide, which were used in great number before I was born.

In this country there was also a great deal of large refrigerating equipment, in fact at the World's Fair in Chicago in 1893.

The Court: Wasn't it in 1892?

Mr. Frye: In 1892.

Anheuser-Busch Co. exhibited 500-pound refrigeration machine at Chicago World's Fair, in 1892.

The Witness: At that place there was a 500 ton machine, an exhibit that was built for the Anheuser-Busch Company of St. Louis, and is still working down there but was on exhibit in Chicago. There was one shown at a food show in Chicago in 1895. This was the Chicago Pure Food Show, and this was built by a company called the Economical Refrigerating Machine Company, and was a very interesting little outfit, and was advertised for several years following that. It did not work automatically, however, in the sense of its starting and stopping itself, that had to be done by manual work, because they did not at that time have successful thermostats that would regulate within a certain range and that could be bought at anything like a reasonable price.

At the time that I first began to have any knowledge of the industry or was exposed to that knowledge, at least, electrical current was a pretty high priced thing, was not in universal use. In our own country, I know, we had lamps, kerosene lamps at that time, the fellow that could have gas even was considered quite well to do, and in that town I lived in electricity was rather rare, it was not available for lighting or for any power that is used in the house and besides that the only current was a direct current, which does not quite lend itself so well to the operation of small motors such as we use here, as the alternating current, although both are used, but the use of the alternating was very rare at that time.

The Court: Can you hitch your machine up to either one?

The Witness: By using the proper motor, that is, we use a motor built for direct current if we use it that way.

The Court: You could not use the same motor for both?

The Witness: No. There are universal motors built, but we do not happen to use them on the machine. They sacrifice a little to each side, and they are not as good as an alternating current, used in alternating and not quite as good as direct current used on direct, but they are using a universal.

As early as 1897 we made—we met, in technical papers, talk of a cheap and reliable power in connection with this industry. It was said that if such a thing were available so they could use motors at anything like an economical rate, that domestic refrigeration would become an established success.

Mr. Cooper: I think I would like to offer an objection here, if the gentleman is going to speak of what was published, the publications ought to be produced, I think.

Mr. Frye: We are prepared to produce any publication to which he refers.

The Court: I understand what he is doing is giving a history.

Mr. Frye: A bird's eye view.

The Court: That is not disputed on either side. If I find any part of it is in dispute I will eliminate it from my mind, and require strict proof about it but I understand him to say—

Mr. Frye: I am trying to prevent the cumbering of the record with a lot of publications, but we have the publications if the other side desire them.

The Court: If there is any dispute, as I say, about the history of it being correct that is of any importance, I will require the proof.

Mr. Cooper: A statement that in the years 1900 and 1910 that gas was a rarity for house lighting or electric current was not commonly used, I would dispute very strenuously from my own recollection, as I was quite conversant with conditions during that time, and if the gentleman states that I would dispute it seriously.

The Court: He said in the town where he lived. I don't know which town that was, but that was true in the town where I lived too, but it was not much of a town in size.

Mr. Cooper: I was in a small town too, and there was lots of electric current between 1900 and 1910.

Mr. Frye: He said it was expensive in those days and hard to get.

Mr. Cooper: I am not going to bicker with counsel as to what was said.

Mr. Frye: That was my understanding of it, I thought the rest of you understood it that way.

The Witness: I did not refer to 1910, I referred to the time I first began to hear of refrigeration, about 1900, and I, like his Honor, lived in a small town where they did not have some of the things we have today, in New York.

Mr. Cooper: I did not live in New York.

The Court: Along about 1900 they had organized a little company in the town where I lived, of their own, and later the Consumers Power Company came along and took it over. I imagine that was the experience of small towns.

Q. 21 Well, stick as much as possible to the real refrigerating industry without going into general conditions, as much as possible.

Machine invented by French priest, Audiffren, placed on market in France in 1904.

A. Well, in 1904, of which fact I heard later, not at that particular time, there was a machine placed on the market by a company in France, it was to be manufactured by—it was invented by a French priest named Audiffren.

Mr. Cooper: I object to that, any use has to be limited to this country, and there is no use spending time on it.

The Court: Well, none of these are said to be directly affected by the patent here.

Mr. Frye: It is explanatory. We say that the Audiffren is a French patent and is plead in the answer, and the American patent is also plead in the answer.

Mr. Cooper: These are perfectly proper, I raise no question about that, but when they say something was done in France I raise the question.

The Court: You may proceed.

Q. 22 Later on, of course, the machine was brought here?

A. Later on of course the machine was brought to this country and was the first successful domestic machine of which I heard, that is, I mean, that came to my more or less direct attention through talk and so forth, as being one that seemed to go along and stay on the market for a long time, and I might say that machine is still being sold in the city of New York.

Q. 23 Do you know who manufactures and sells it in the United States of America?

A. H. W. Johns-Manville Company.

Q. 24 Headquarters at New York?

A. As far as I know, yes.

The Court: How am I going to find out something about what kind of a machine that is?

Mr. Frye: That will all go in, your Honor; the patents are in, and we will be glad to show the exact machine.

The Witness: That machine, I might say, used sulphur dioxide.

The Court: Do they still use it?

The Witness: Yes, sir. That machine was also both air and water cooled.

The Court: And that came to this country and began to be sold here about when?

The Witness: Oh, I should say about—well, I think it came to the country very shortly after, but I think about the first I heard of it was about 1910, I should say, or 1908, something like that.

Many other persons of course at this time were continuing to make small machines and sell them. I spoke of the one shown at the Chicago food show, and technical papers at that time and later that I have seen commented at length on the great number of domestic machines that were being put before the public at that time; also in 1895 in a publication I later saw I read that a tremendous number of such small machines had appeared during the preceding 18 months. It spoke particularly of the 18 months preceding that. In 1908 at the electrical show held in the Coliseum in Chicago, what they called a house of electricity—we later have different names for such things today, but it means practically the same thing, a technical refrigerating magazine, and the periodicals at that time spoke of the various articles, articles requiring electric power that were in the house to make it a place of convenience. Among the things they discussed was the laundry equipment, such as washing machines, ironers, electric sweepers, electric cookers and so forth. They speak particularly of an electric refrigerating machine that was installed in a little alcove adjoining the kitchen. This electrically driven refrigerating machine was manufactured by the Brunswick Refrigerating Machine Company of New Brunswick, N. J., who still make such machines, a very large successful company.

The Court: What is their refrigerant?

The Witness: Ammonia.

The Court: Water cooled?

The Witness: Yes, sir.

The Court: And this French machine that you speak of?

The Witness: Both air and water.

Mr. Cooper: It was not used until 1920, to be frank about it, was it, the Audiffern?

Mr. Frye: We object absolutely to that, we will prove it was air almost from the inception.

Mr. Cooper: Well, may I ask a question, is all?

The Court: Well, I will be governed by the proof on that since it is something you disputed, but I am admitting this perhaps like I would a good deal, the matter on an opening statement by counsel.

The Witness: It was stated in the technical papers at that time that this machine—

Mr. Frye: While we are on that point, your Honor, we would like to call your attention to the article referred to in April 1904, page 251, here is the description in an American publication named Ice and Refrigeration, under date of April 1904, referring to the discovery and specifically to the machine of Audiffern.

The Court: That is the Frenchman you have been talking about?

The Witness: Yes. It is over a two column article and represents specifically—refers specifically to the SO2 as the refrigerant, and calls the operation a cycle of operations.

The Court: There is nothing there about that being air cooled in that particular article.

The Witness: Well, from the showing you cannot tell, but from the patents we believe we can tell very quickly.

The Court: That was the only thing that was disputed about it, I take it, there was no dispute about their using sulphur dioxide, but the dispute was that it was air cooled.

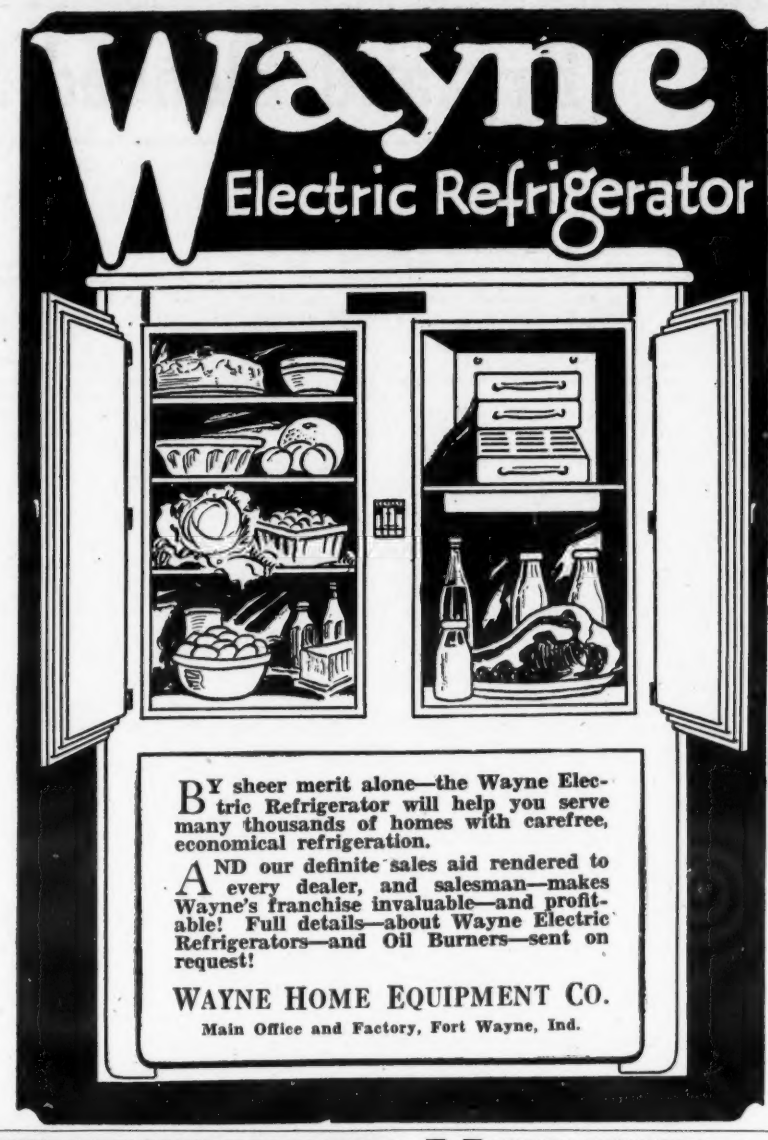
Mr. Frye: Your Honor, we contend and believe we will prove clearly that air and water machines developed simultaneously, and some of those referred to were water cooled, others air cooled, some large and some small, domestic or household, or whatever term is used.

Thermostats developed by the electrical industry.

The Witness: I was speaking of the exhibit in 1908 of the Chicago electrical show, in which the house of electricity is discussed. Technical papers at that time also commented on the fact that the machines ran ten hours a day, being stopped and started manually. They remarked that a thermostat could be procured, but naturally did not show one, because it was probably a very expensive article, but they did remark that such a thing was possible to have, and such a thing could be furnished to make the thing fully automatic. From this time on there was a steady improvement, other inventions and other experimentations with thermostats and other electrical appliances. The refrigerating industry as a whole at that time, at least as far as my knowledge went, had nothing to do with the development. That was made altogether by the electrical industry, and such persons who devote themselves to making electrical appliances only, and generally when people building refrigerating machines wish to have the use of such an article, they purchase something of that kind just as we still do, we do not manufacture thermostats, although we have made them, but believe we can buy a better one for less price than we can make it. We make nothing electrical. All of the things that we use of that kind are bought of people who make those regularly and as far as I know are not in dispute in this suit. The use of the small copper tubing for working of this kind had become very common in 1908, and no doubt that is before that time we got—I remember of having seen an article in 1908 describing the use of such tubing.

The advertising of automatic machines had now, through the success in manufacturing electrical appliances, become quite general in magazines devoted to discussion of the refrigerating industry, and around 1913, and even before that time, papers were full of articles describing fully automatic machines. In fact, there was one company—still in existence I believe, the Hartford Automatic Refrigerating Machine

(Continued on page 33)



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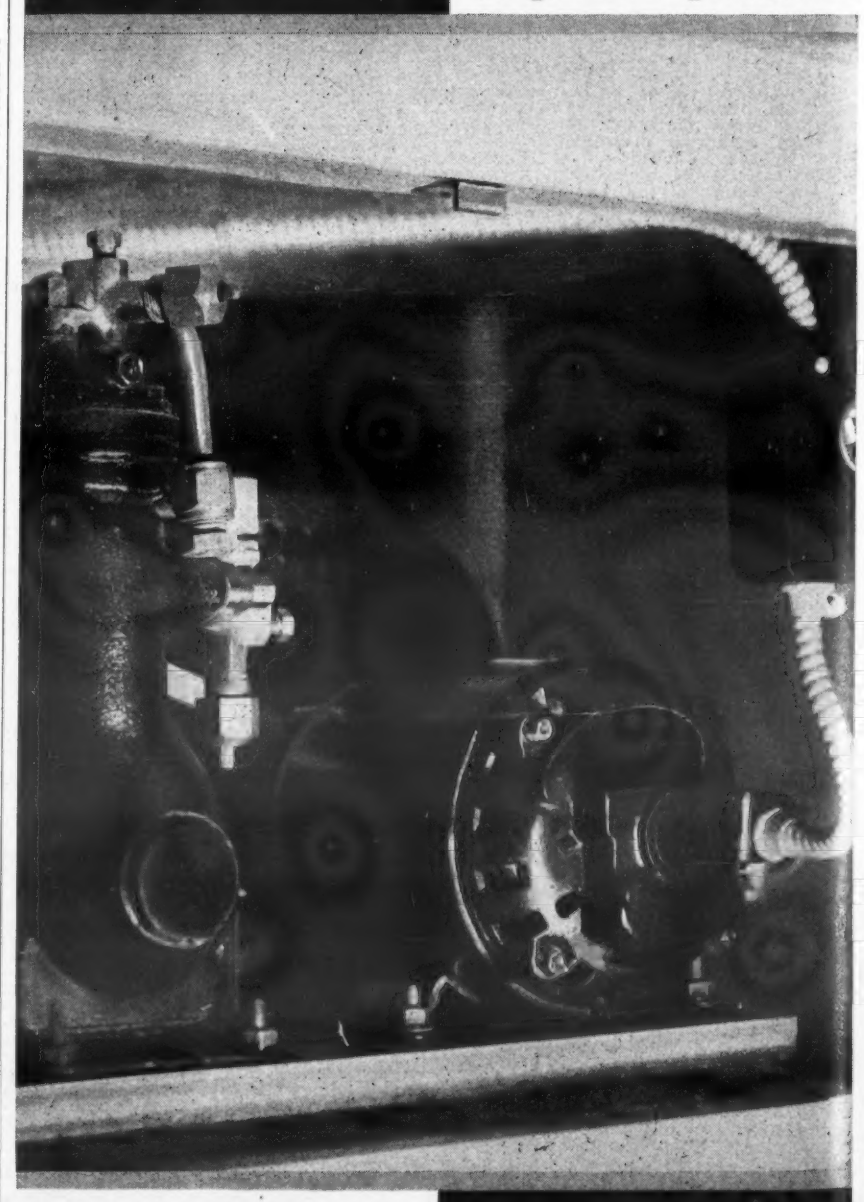

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Literature on Request

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Early Installations of Domestic Refrigeration Recalled

Company—that carried ads for a long time describing themselves as being able to furnish automatic refrigerating machines.

In 1914 the Domelre machine was first drawn to my attention through a publication, or at least, I mean I saw afterwards the publication that described that machine.

Mr. Cooper: What date was that?

The Witness: I believe the machine—

Mr. Cooper: No, what date was it called to your attention?

The Witness: Oh, I should say I heard of that machine first about 1915 or 1916, I think, that there was such a machine. I did not see it, and in fact have never seen one, but publications carried a story of it in 1914. I have seen such publications.

A. (Continued) That, your Honor, is about the story generally up to the date of some of the patents in issue here, of the general refrigerating machine business that began, we will say, about—I think I began to talk of things that happened about 1890, although there was a very active industry and machines were all over the country from one end to the other end, long years prior to that, the first of it being, as I pointed out, felt about 1834.

Q. 25. Have you finished the answer?

A. Yes, sir.

Q. 26. Let me ask you if you have made it a practice, during the years of your experience as a mechanical engineer, to note advertisements in particularly refrigerating periodicals or books, concerning competitors' machines.

A. Well, of course, our company was not a competitor in the early years but I have, since we became interested from that viewpoint, I surely have noted such advertisements, but in the early days, even as early as 1904, I always looked over the advertisements of the magazine, "Ice and Refrigeration," which came to the plant I was working in, and those advertisements were always a source of great interest, and I read the magazine as well as observing the advertisements.

Q. 27. Well, did you note from time to time, or have you specially investigated later the advertisements of household machines prior to 1913? Did you ever see any advertisements of machines on the market for household or domestic use?

Brunswick machine installed in Detroit home in 1909.

A. Very often, and even as early as 1910, a certain machine was called to my attention for household use. In fact, I worked for a very short time for that company, simply as a man out in the field. I had occasion to erect a small machine in the Ste. Claire Hotel in Detroit, made by the Brunswick Company, and at that time Mr. H. B. Joy of Detroit—in fact, that was 1909, I want to correct that date—about August 1909, Mr. H. B. Joy, who lived in Grosse Pointe, outside of Detroit, also purchased such a machine for his home, and while I did not see it, I thought I was going to have a chance to erect it, but was kept busy on the job where I was, and did not get that opportunity—but such a machine was purchased there and erected, and was known to me.

Q. 28. Well, to your knowledge, the Brunswick Company made machines for domestic use as early as 1910, or when was it?

A. 1909, I believe I first knew that.

Q. 29. Did you ever see any catalogues or other advertisements of the Brunswick Company?

A. Yes, I have.

Q. 30 (Continuing) Relating to domestic machines?

A. Yes, sir.

Q. 31. I call your attention to a catalogue marked "Refrigeration in Modern Homes," which was put out by the Brunswick Refrigerating Company, of New Brunswick, New Jersey, and ask you if you recognize that catalogue?

A. Yes, I recognize that catalogue.

Mr. Cooper: Well, it has to be proved, I suppose, some way or another.

Mr. Frye: That will be taken care of.

Q. 32. Did you say "Yes"?

A. Yes, I did.

Q. 33. Will you tell just briefly, tell his Honor if it refers to installations in households of refrigerators, automatic refrigerators made by the Brunswick Company ahead of 1913?

Mr. Cooper: Well, that would have to be of the witness' own knowledge, it cannot be proved by referring to something in the catalogue, even by a witness who was competent to prove the catalogue.

A. This catalogue is dated 1908.

Mr. Cooper: If your Honor please, I object to that sort of statement. The catalogue is susceptible of proof, and I have not heard the witness' testimony that he has had anything to do with the issuance of the catalogue, or knowledge of it at that time.

Mr. Frye: Your Honor, the chief engineer of the Brunswick Company will be here tomorrow morning.

The Court: I will accept your promise at this time.

Mr. Frye: Well, I would rather, your Honor, to withdraw it until then, in view of the objections. We have other ads that we believe will be equally convincing, and as I say, the other gentleman will be here that will, I think, obviate all objections.

Q. 34. Now, I call your attention to a publication, "Ice and Refrigeration," page 75 of the November 1913 issue and ask if that is a type of advertisement that you have been referring, pointing to an advertising of the Portsmouth Engine Company relating to small refrigerating plants.

Mr. Cooper: Is this something set up in your answer?

Mr. Frye: I believe that one was. It is not used for that purpose, Mr. Cooper.

It is to attempt to show that this particular gentleman was conversant with the development at the time that he has referred.

Mr. Cooper: Showing an advertisement in the publication you produced now does not advance that proposition at all.

Mr. Frye: He has made the statement—

Mr. Cooper: Ask him if he knew this at the time, that is the question.

Mr. Frye: Well, I think he—

Mr. Cooper: Ask him the question. I will ask him: Did you know this advertisement at the time?

The Witness: I don't remember this particular one in 1913.

Mr. Cooper: Well, doesn't that exhaust the matter, as far as that is concerned?

Q. 35 Will you pick out certain of the advertisements that you refer to in your testimony, as you having seen from time to time, as you refer to, about the development of the small machines? How long will it take you to select those from the books in court?

A. It might take a considerable time. It would mean thumbing over a lot of the books proper, some of them were even before, I think we have—some of them were 1905 and 1906, I remember that.

Q. 36 Well, could you have it ready at the resumption of Court at two o'clock?

A. I would try to; yes, sir.

Mr. Frye: Well, I would like to postpone the answer to that question, your Honor, to give him a chance to select them outside of Court hours.

Q. 37 You have made direct reference to the Audiffren machine as referred to in a magazine of 1904. Now, I would call your attention to that article in the publication "Ice" of August, 1912, the page number being 20, and ask you if you were familiar with the particular article in the usual way, as a mechanical engineer receiving that magazine?

A. Well, this particular magazine I did not receive, or do not at least remember it; at that time, I saw several, but this is not an article that I saw in that particular magazine at that time.

Q. 38 Do you remember when you did see it, if at all?

A. I don't believe I could fix that date clearly, but I should say something like 1913 or 1914, articles of this kind were coming out that I remember of seeing, different ones. I do not remember this one particularly, but I remember the Audiffren machine being described as a so-called "Dumb-bell" proposition as we—

Q. 39. In your various magazines, you mean that you knew of generally, from seeing it?

A. Oh, I knew it generally, in fact I think some of them were in the city of Detroit, and through talks with engineers and through magazine articles being called to my attention, I knew of it generally possibly as early as 1912.

Q. 40 Did you ever see one of the Audiffren machines in operation?

A. Yes, I have.

Q. 41 About when was that?

A. Well, that is comparatively recent, I should think about two years ago I saw one in operation, three years ago, possibly.

The Court: We will take a five-minute recess.

(Recess.)

Q. 42 Now, Mr. Hayes, in your experience with refrigeration machines, have you been personally familiar with the manufacture and operation of ammonia machines—that is, having ammonia for the refrigerant?

A. Have had a great deal of experience in that line or work.

Q. 43 Was ammonia used for large and small machines?

A. Yes, I have used it for machines as low as possibly a couple of hundred pounds capacity, 200 pounds of refrigeration per day, and I have personally constructed plants and operated them that ran up six or seven hundred tons a day refrigeration.

Q. 44 Now, in the condensing apparatus of these ammonia machines, what was ordinarily used in the way of cooling, water or air?

Ammonia systems in ice plants cooled by air alone during winter.

A. We used, ordinarily, in the summer time at least, water that trickled over the outside of a pipe. That particular type of condenser was known as the atmospheric type, and so known generally through the trade; it is so called because such condensers are always placed upon the roof or some place where the air has free access to them, and as I say, in the summer time we trickle water over those pipes in order that we may get the fullest work out of a given amount of surface. But as winter comes on and we really don't need all the condenser, and in order to get away from the trouble that comes through ice forming on condensers so operated, and in the cooling towers and so forth, we have for years, from the very first that I remember, operated those things in great measure by air alone.

Q. 45 Will you state to the Court some specific locations where ammonia refrigerator machines were used with condensers that were air cooled only, at least during a portion of the year?

A. Well, I know from actual experience, the old independent Ice & Fuel Company, at Richmond, Indiana, in 1900 and 1901, 1902, 1903 and 1904, and I know through experience the plants of the Peoples Ice Company, one plant in particular, their so-called Warren Avenue plant, where I worked as an assistant to the Chief Engineer in 1908 and 1909. Such a plant at that time in refrigerating capacity was about 350 tons, and a portion of that plant was operated during the winter time using all of the condenser, and the condenser air cooled.

By the way, I did that also in 1915, when I was chief engineer at that particular plant, and under my direction it was done at other plants of the company in later years right along, but I actually—

Q. 46 (Interrupting) Restrain it to before 1913, Mr. Witness, please.

A. Well, that experience of 1909 would certainly apply to that, then, and that was my own personal work, because I was standing operating watch at that time.

Q. 47 Well now, were these compressors set so that the air would ordinarily circulate around them?

A. Do you refer to compressor or condenser?

Q. 48 Condenser. Did I say compressor?

A. Yes.

Q. 49. Will you change that, please?

A. Yes, they were built special, with the idea in view, as I said, they were built on a roof with the structure out at the sides, in some cases no structure above at all. In my particular case, however, there was a cooling tower above there which formed the upper structure, but there is no sides at all in that particular plant. The cooling tower was set on posts only, there was not even the customary louvre to protect the street from the water flying, because at that time that plant was set in such a way that it did not bother anyone along the street. In fact, I believe that plant still—in fact, I know it is—still without any protection at all on the side where the condensers are, and that is totally exposed so that the air may come in from all four sides.

Q. 50 Now, you have told us of your personal experiences with air cooled condensers during at least a portion of the year. Can you tell us whether it was common knowledge among engineers at that time that this was standard custom in plants other than those with which you were personally familiar?

A. It certainly was a standard custom, because actual conditions forced it, to keep from forming ice around there and also because during the winter time plants were generally run at reduced capacity, and of course, it worked very easily into an operation of the nature I have described.

Q. 51 Would you state it as your opinion, as an experienced mechanical engineer, that air cooling and water cooling in refrigeration condensers are equally effective?

Condenser of larger capacity required for air cooling.

A. Yes, within certain ranges except this. Of course, it requires a great deal more surface for air cooling than it does for water. You can take a condenser of very much smaller external surface and get plenty of work, more work using water—wait a minute: I say you can take a condenser of much smaller capacity and use water on it and get much more effective work than you can do with air of the same surface, of course.

Q. 52 But the result is precisely the same, is it?

A. Well, if the air is cold enough, of course, to do that, and you have surface enough. Those are two prime requisites. For instance, in summer time, if we had water available at 80 degrees and the air around there was 80 degrees, and you had enough of surface of a condenser, you can get precisely the same results with air as with water.

Q. 53 Then it is only a question of temperature of the medium, whether air or water, and the surface area of the condenser?

A. Absolutely.

Q. 54 Has that been known to refrigerating engineers for many years?

A. Yes, it is such an obvious fact—

Q. 55 Please answer the question.

A. Yes.

Q. 56 Has it been known to your knowledge?

A. Yes.

Q. 57 Now, are there ways of computing surface area needed for use with either air or water, as the condensing medium?

A. Yes, sir.

Q. 58 Now, do such methods of computation differ from the ordinary laws of thermo-dynamics, and the well known tables and principles that have been laid down in many text books?

Mr. Cooper: That is just a trifle leading, but I suppose counsel might as well put his statement on the record, as a matter of fact, as put the question in that form.

Mr. Frye: I am trying to get three questions into one.

Mr. Cooper: No, I think you are trying to get your answer in one question.

Mr. Frye: Let's reframe the question, Mr. Stenographer.

Q. 57 Where do you find such computations?

Formulas for estimating rate of heat transfer through metals given in Siebel's Compend of Mechanical Refrigeration.

A. In various text books, for instance, nearly any book on heat exchange would tell how surfaces are calculated so that heat may pass from one side of a wall to the other, a metal wall. One specific book that I have in mind is Siebel's Compend of Mechanical Refrigeration, which book first came to my attention in 1903, and it has been in my possession since; that is, the various editions of it have; where it is shown, and formulae are there given for figuring heat transfer.

Q. 58 Are there also publications or places where you secure data for the boiling points, etc., of various refrigerants?

A. Yes, that is, very old tables have been computed on that, and we have them.

Q. 59. Now, generally, would you say that sufficient data has been published in the books that you refer to, say 20 years ago, to enable the use of an air cooled condenser?

A. Without any trouble—

Mr. Cooper: Wait a minute, if your Honor please. That, of course, calls for a conclusion of law, and it is based upon an assumption of facts that is not before the Court.

The Court: The objection is overruled.

A. There was plenty of data at that time to allow anyone to figure the amount of heat that would pass from inside a condenser pipe to the outside, cooled with air or any other medium.

Q. 60 Have you, in your experience as a refrigerating engineer had occasion to use copper tubing?

A. Yes.

Q. 61 Of various sizes?

A. Various sizes.

Q. 62 And was it, to your knowledge, a standard article of commerce ahead of 1913?

A. It has been for many years.

Q. 63 Please answer the question. You mean many years ahead of 1913?

A. Yes.

Q. 64 About when did you first come into personal knowledge with what is conventionally called copper tubing?

A. I do not really remember the first time. As a boy I remember seeing lots of copper tubing. I don't know that I can state just when the first time was.

Q. 65 Well, was it 25 years ago, 30 years ago, or where would you surmise?

A. Well, it was certainly 25 years ago.

Q. 66 Well, now, restraining to when you were in the refrigerating business, when do you first remember using copper tubing of 3-8 inch diameter?

A. Well, you mean for refrigerating purposes?

Q. 67 I don't care where you used it: I want to know if you personally used it to any extent?

A. Not to any great extent. I know about it, but I did not have a great deal of use for such stuff in an ammonia plant, except for maybe putting up an oil line or something of that kind, from an oil pump. Then maybe we would use a little of it. That was not a great deal, but it was something, go out and buy a piece if we wanted it for that. I remember putting up an oil line once about 1909, where we desired to pump oil from an oil pump up to a lubricator on a Corliss Engine, and a piece of small copper tubing was used for that.

Q. 68 Copper is not particularly adaptable for ammonia, is that what you meant?

A. Well, only from the standpoint that ammonia attacks all alloys of copper, and therefore we don't use it where we bring the ammonia in direct contact with the copper tubing.

Q. 69 Do you know of any ways of treating copper tubing so that it can be used with ammonia?

A. It can be protected by a coating of tin or some other metal, that is not susceptible to ammonia fumes.

Q. 70 Is that well known to engineers?

A. Oh yes, sure.

Q. 71 Including refrigerating engineers?

A. Absolutely.

Q. 72 Do you think it was known prior to 1913?

A. Oh yes, without a doubt.

Q. 73 Now, are you familiar with the various types of condensers that are used in household refrigerating machines?

A. Yes, I am.

Q. 74 I am speaking of the conventional household refrigerating machine of today.

A. Yes, sir.

Q. 75 Is there any way of computing the thermal efficiency of a condenser?

A. Yes, sir.

Q. 76 (Continuing) When you examine it? What do you have to know in order to do that?

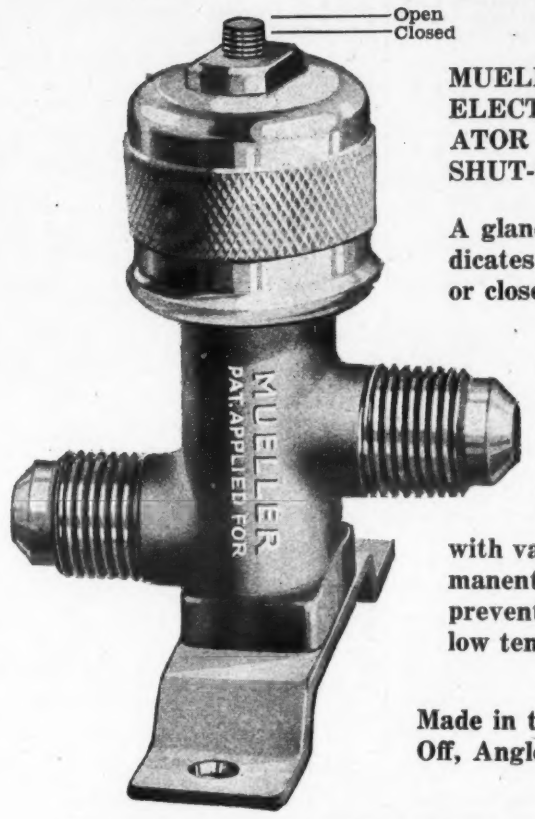
A. Well, I ought to know the surface of

(Continued on page 34)

Mueller Brass Co.

Headquarters for

Electric Refrigerator Valves and Fittings



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Made with very rugged, compact construction; cannot be taken apart or damaged. Head is packed with vaseline to give permanent lubrication and prevent condensation at low temperatures.

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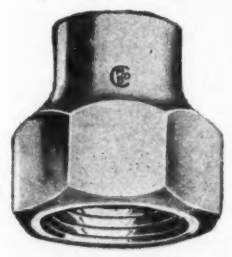
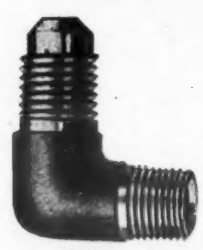
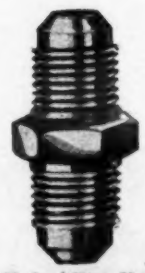


Forged Nut



Elbow

Cross



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THREE GENERATIONS OF BRASS MAKING

Flintlock Condenser Described

the fin, that is in area, I sometimes like to know the thickness, unless it is within certain well defined limits; I would want to know the so-called prime surface of the coil, if it is made up from a pipe. All of them are not made up from pipe tubes, but I would like to know that surface if there be such a surface of that kind, and knowing the relationship that the fin bears to prime surfaces, why, it would not be very difficult to calculate how much heat would be transferred there with certain temperature differences.

Q. 77 Without having you work out an equation, so to speak, you saw yesterday, I believe, the condenser of the plaintiff?

A. Yes.

Q. 78 Exhibit 13. Now, would you state that it could be readily figured as to what the thermal efficiency was?

A. Yes, it is that fin surface roughly, just on a casual examination, ought to be about half of the value of the so-called prime surface of the coil.

Q. 79 Prime surface is what?

A. Is that part of the condenser that is a tube proper, just the tube, I take it that is a copper tube and the fin is fastened outside of it, and I presume with a metallic contact like solder.

The Court: He is speaking of the—

The Witness: Well, I think he is talking about the radiator, your Honor.

Mr. Frye: The one he brought in special, with fins on it.

The Court: Oh, yes, but if we would take the plaintiff's exhibit 9—

Mr. Frye: That is still a different kind.

The Court: But I say, that would have to be taken into account, I suppose.

The Witness: Oh, yes.

Q. 80 Now, where a condenser of tubular construction only, such as in exhibit *I*, do you figure it all as prime surface?

A. That part of the coil that would not have the fin attached to it would be prime surface; the pipe alone, I am speaking of.

Q. 81. Take for example exhibit 7, which is the defendant's construction refrigerator, there is no fins on that condenser, is there?

A. That is a coil, a flat copper coil.

Q. 82. That would be all prime surface?

A. Yes, sir, every bit of it.

Q. 83. And comparatively simple to figure on thermal efficiency?

A. Very simple, yes.

Q. 84. Is it the size of the tubing that counts, or the area in contact with the gas?

A. The area only.

Q. 85. And you can figure area regardless of size of tubing?

A. Absolutely.

Q. 86. That is merely one factor that enters into it?

A. Yes.

Q. 87. Well, do you think that this knowledge of how to compute these things was well known to refrigerating engineers generally prior to 1913?

Mr. Cooper: I will object to that as leading. It does seem to me that counsel, if he regards the point as critical, should ask the witness and not force the witness.

The Court: The objection is overruled.

A. Those computations, as I spoke before, of telling how to figure the passage of heat from liquid on the one side to air on the outside, or of gas on the inside to air outside and so forth, are all given in Siebel's books, from the very first that I remember of. Therefore, any engineer who had common access to text books—

Q. 88. Well, I was restricting this question, or intending to, to the knowledge that it was surface area and not diameters of tubes that refrigerating engineers considered in planning their condenser sizes.

A. I do not see how diameters would enter into it at all. It is merely, as I spoke from the first, surface altogether. I do not see how the diameter would enter.

Flintlock Condenser does not use tubing—is formed by a series of stacked fins.

Q. 89. Do you know any condensers that are on the market that do not use tubes?

A. Yes, the Flintlock Company are at present making a condenser in which plates of copper are punched, and—or plates of brass are punched in such a way that in punching the hole through a little piece there is a little extension left where the punch goes through. They stack those in such a way, I understand that is a punched arrangement, in such a way that they do not use—that you have one fin after the other, and the opening through there is provided where the hole has been punched. In other words, it is not built up from a tube at all, or a pipe, but is formed by a series of stacked fins.

Q. 90. Is the condenser of which you speak in more or less general use?

A. I think it is one of the most popular and widely sold of present condensers of that type.

Q. 91. Is it used by your own company?

A. Some of them, yes, sir.

Q. 92. Can you mention any other company that you know using that type of radiator today?

A. I think at some time or other, I have seen the condensers on practically every refrigerating machine that has come to my attention. I think I recollect seeing one on a Kelvinator outfit, and I believe I have seen it on a Frigidaire, and certainly many of the smaller companies, the Copeland—and I am not mentioning the Copeland as a small company.

Mr. Cooper: These are all Flintlocks, or whatever you call them?

The Witness: Yes, Flintlock condensers.

Q. 93. Well, without naming those companies, it is your knowledge that it is used with a number of companies?

A. A number of companies, yes.

Q. 94. Are the condensers of such companies air cooled or water cooled?

A. Air.

Q. 95. Now, you heard the testimony of Mr. Harlan to the effect that the air cooled Fridigaire machine reached the market in, I believe, 1924. If I am wrong on that, I want to get it right.

Mr. Byrne: About that time, 1924, 1925.

Mr. Cooper: 1924; many thousands of them sold in 1924.

Mr. Frye: Well, I thought that was the testimony. I want to get it right.

Q. 96. When did you, as a mechanical engineer in refrigeration work, first see an air cooled machine for use in indoor work, so to speak?

A. I think—well, it is pretty hard to fix that date.

Q. 97. Well, approximately; I don't want the day or week, of course.

A. Well, I imagine about 1920, as far as I remember just right now. I believe a Kelvinator was that kind of machine that I saw first.

Q. 98. Do you know when the Kelvinator first reached the market.

A. No. I do not.

Q. 99. But the first one you saw was about 1920?

A. As I remember now, it may have been before that.

Q. 100 Do you know whether Kelvinator continued to make air cooled condensers from that time to the present day?

A. Yes, they are making them right now.

Q. 101 Do you know of any others on the market prior to 1924?

A. That I saw personally, you mean?

Q. 102 That you were cognizant of.

A. Before 1924?

Q. 103. Before 1924.

A. Servel and Copeland. Well, there was some others, too, I am sure. I don't recall them just this moment. I certainly know of the Copeland. In fact, I saw a Copeland machine before they organized as a company, when Mr. Copeland drew my attention to such an outfit.

Q. 104 Do you know whether those machines have remained on the market since you saw them?

A. Yes, sir.

Q. 105 And all three that you have mentioned are being sold today?

A. Yes.

Mr. Frye: Take the witness.

Cross Examination

By Mr. Cooper:

XQ. 106. All three of these companies that you have mentioned, Kelvinator, Servel and Copeland, have used a ⅜ of an inch copper condensing coil, haven't they?

A. I don't remember of having measured the coil at that time, but it runs in my mind that was possibly about it.

XQ. 107 And I suppose Mr. Copeland and these other gentlemen have spoken to you that—or some of their representatives—that they are being sued by this plaintiff.

A. Yes, I know there is a suit with Copeland on.

XQ. 108 And you know that their representatives have been co-operating with you in the defense of this case?

A. I certainly do not know any such thing.

XQ 109. Oh, don't know that. Who would know about that?

A. I would know as much about that as anybody, because I am in charge of this suit for our company.

XQ. 110 And you would say it is not the fact?

A. Not a fact.

XQ. 111. Now, will you tell me just what you were doing in the year 1912, where your employment was them?

A. At the hotel Ste. Claire in Detroit, as chief engineer of that company and operating the power plant and so forth.

XQ. 112 And it was at that time, or it was at that place, that you had attended to the installation of the Brunswick Refrigerator?

A. It was at that place, but at an earlier date.

XQ. 113 1909—put that in?

A. August, 1909.

XQ. 114 Now, what capacity was that machine?

A. About a 15 ton machine.

XQ. 115 Made 15 tons of ice per day?

A. No, had a refrigerating capacity equal to the melting of 15 tons of ice, which would be practically, in the case of that machine, about half, it would make about half that much ice if it had been so built to do.

XQ. 116 When, after the installation, did you take employment with the St. Clair hotel?

A. In the following year, January, 1910.

XQ. 117 And you had charge of the operation of the Brunswick plant?

A. Yes.

XQ. 118 And that was a part of your duties as engineer there, to see that the plant was running properly?

A. Correct.

XQ. 119 And you continued on there to what time?

A. About March, 1915.

XQ. 120 When was it that the defendant began to sell these refrigerators such as this exhibit 7 back here?

A. About the very late fall of 1925, I should say even the last day or the last month of the year, about 19—about December, 1925; but the machine had previously been sold for about three years by our predecessor from whom we bought it.

XQ. 121 So you did not design that?

A. I did not design that particular machine.

XQ. 122 And at that time, how long had you been with the General Necessities?

A. Since 1915 up to 1925—about ten years.

XQ. 123 And during all that time, you had all this information you have given here about the principle in a small machine being the same as the principle of the large machine with which you had been familiar before, and that all that was required was to make the machines smaller, as I think you have said?

A. So far as principle is concerned, yes.

XQ. 124 Now, during the first part of your examination, when your testimony was, as I would put it, largely in the form of a lecture, you made quite frequent reference to this hand book entitled "Absopure Frigerator Service Manual," did you not?

A. Yes, sir.

XQ. 125 And from it you took the water melon, so to speak, that came into your testimony?

A. I put it in there.

XQ. 126 You put it in this book?

A. Yes.

XQ. 127 It was one of the things you put in the book, was it?

A. Yes, the chapter between 18 and 35—or the pages between 18 and 35, something like that, I wrote.

Technical papers on methyl chloride by Roessler & Haslacher Chemical Co., quoted in service manual.

XQ. 128 Now, I notice, for example, on page 1 of this book, the statement, "The technical papers of the Roessler & Haslacher Chemical Company have been drawn on freely in preparing this article." That is according to your understanding of that part of the book?

A. Not that part of the book. That is purely given to principles, that particular part of which I spoke. I think the Roessler & Haslacher Company, their stuff is under the work on methyl chloride.

XQ. 129 And whatever there is in here about methyl chloride is taken, as it says here, from the technical papers of Roessler & Haslacher?

A. Largely from that.

XQ. 130 Well, I find on a leaf that is inserted between pages numbered 6 and 7 a paper or sheet bearing the caption "Section B, Theory of Mechanical Refrigeration (Technical)," followed by this note: "The Standard Encylopedia and Encyclopedia Britannica have been drawn on freely in preparing this section."

A. I think that was taken bodily from the encyclopedia by the man that edited that book.

XQ. 131 And your testimony as to the mechanical refrigeration, as you gave it in the lecture part of your evidence, was based upon this?

A. It certainly was not. I knew it—

XQ. 132 But I mean, as you were up on the stand, you had this in your hand and referred to it in giving your testimony.

A. I referred to that section of it which I wrote myself, between the pages 18 and 35.

XQ. 133 Only?

A. Only.

XQ. 134 Now, I notice on page 34, which comes within your creation, this statement: "Dense air system: This system depends on the compression of a gas without reducing it to a liquid. "he gas thus compressed is raised to a high temperature, but is not raised to such a pressure as would make its liquefication possible." Do you remember writing that?

A. Correct; yes, sir.

XQ. 135 And the final sentence of that passage is this: "This system has never been successfully employed for household outfits." That is in accordance with your knowledge?

A. So far as I remember, I don't know of any such air system—

XQ. 136 No, now, wait a minute. I would like to have you answer the question, and not deliver another lecture. I am asking you whether that statement is a statement of your present opinion?

A. Certainly—dense air systems, I mean by that.

XQ. 137 You mean by that just what you say here, "A system which depends on the compression of a gas without reducing it to a liquid."

A. Correct.

XQ. 138 And that gas, as you state it there, is any refrigerant, isn't it?

A. Well, air system. Air is the only thing I have ever known being used for that.

XQ. 139 Well, you make the statement, "This system depends on the compression of a gas without reducing it to a liquid."

A. Correct; air is a gas.

XQ. 140 This is not limited to air, though?

A. Well, that practice, so far as I know, has been limited to air—

XQ. 141 I am asking you for your opinion. Is it your opinion that the system in which the refrigerant, though compressed and raised to a high temperature, is not raised to such a pressure as would make its liquefication possible"—I am asking, is it your opinion that such a system as that has never been successfully employed for household outfits?

A. No air system, so far as I know—

XQ. 142 Now, wait a minute. I insist on an answer. I am not asking you about air systems.

A. That is what was referred to in that article.

XQ. 143 I am asking you this as your opinion: Is it your opinion that a refrigerant compressed to such a degree as to be raised to a high temperature, but not to the liquefaction point, has never been successfully employed for household outfits?

A. I know of no such case where it has been.

XQ. 144 Would you state whether it is your opinion or is not your opinion? That is what I am asking you.

A. Opinion that one has been used, you mean? I know of none.

XQ. 145 Then it is your opinion that it has not been used?

A. So far as I know—I do not know of any. I had stated that earlier.

XQ. 146 Do you disclaim responsibility for this statement which I find on page 40 of this pamphlet or booklet under the head of "Absopure Condensing Unit." "The condensing unit is made up of the following major parts which are described in detail on the following pages, the compressor, condenser, receiver assembly, and the motor." Is that a correct statement?

A. Yes, it has those elements in it.

XQ. 147 On page 43 I find this statement: "Absopure Refrigerators are the result of years of unceasing effort to produce a simple, reliable refrigerating machine than can be sold at a price within the range of everyone."

A. That is correct.

XQ. 148 Whose efforts are those?

A. Well, mine among others, since the year 1925, the late part of the year 1925.

XQ. 149 Well, what others?

A. Well, the efforts of the people whose work we had years before that.

XQ. 150 What others?

A. Well, any one in the engineering staff or in a position of responsibility generally in the company.

XQ. 151 I find on page 60 this statement under the heading of "Chapter 2, Condenser Receiver Assembly." "This assembly—on early Absopure refrigerating machines—consisted of a continuous copper tube bent in the form of a flat coil, the upper three-quarters of the coil acts as a condenser, and the lower quarter as a receiver."

That is according to your understanding of the operation?

A. Surely.

XQ. 152 Now you made some criticism in the early part of the lecture portion of your testimony of the compression expansion valve.

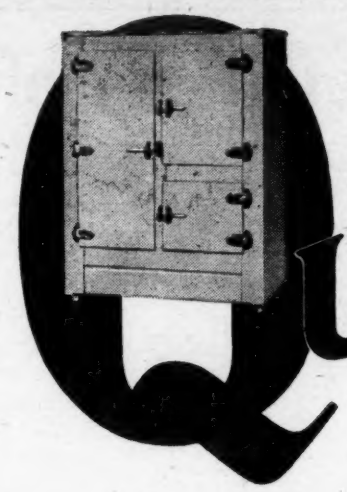
A. Yes, sir.

XQ. 153 I find, beginning on page 73 of this a section headed, "Chapter 1: Expansion valve. Purpose of the expansion valve. Adjusting the expansion valve. Repair of expansion valve." And finally, "Cut of expansion valve." You do not question the propriety of the use of the word "expansion valve" there, do you?

A. Certainly not. That is what it is known to the trade as generally.

XQ. 154 Well, this is a service manual intended to instruct your people, and not for general distribution to the trade, isn't it?

(Continued on page 35)



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Alternating and Direct Current

A. Not for general distribution to the trade, but to any dealer that is with us, or anyone else that is interested in it.

XQ. 155 Well, it says in the introductory part: "Absopure Service Manual. This instruction manual has been very carefully prepared by the engineering department of the Absopure Frigerator for the benefit of the service and installation mentioned."

A. Those are the primary people interested, but you have one in your hand right now.

XQ. 156 Yes, it was handed me by counsel yesterday, if I have to explain my possession of it, because you are referring to it, and I demanded of counsel on the other side that they give me a copy of anything you referred to.

A. I only referred, as I pointed out, to those pages.

XQ. 157 Well, let us try not to be disagreeable to one another—it is none of your business, if I may put it that way, where I got this. You have spoken generally of your familiarity with the household refrigerators of your competitors, and have mentioned a number as having been known to you prior to 1924. I will ask you this question: Did you during the year 1924 become familiar with the Frigidaire product, referring particularly to the air cooled type?

A. I think my first familiarity with that came somewhat afterwards, when it was offered to me by a member of that company, Mr. Calloway, I think it was, some time after 1925 in fact.

XQ. 158 It was before your product was out, wasn't it?

A. I think so.

XQ. 159 You know it, don't you?

A I am pretty sure of it.

XQ. 160 Before Mr. Calloway offered you one you had seen it?

A. Well, I had been buying water cooled units of them, and I think they said, I am not so sure, they did not furnish air cooled, and he was very anxious to have me try some of them, and get me to take a trial order of air cooled machines

XQ. 161 At that time you were—your company was acting as a distributing agent for Delco Light Company in the distribution of this Frigidaire machine?

A. No, we were not, we were in the ice cream business and had referred to Frigidaire the advantage to them of making those cabinets; in fact, a meeting was held in Detroit in which Mr. Harlan, who testified here, Mr. King who is here this morning, Mr. Grant, the then President, and Mr. Calloway, and several others, as well as Mr. Brown and myself, were present, and we represented to them the advantage to them of doing that, and I furnished some drawings, of Mr. Grant's request suggesting some principles, at least, which I told him was all right—

XQ. 162 Well, that is not an answer to anything I asked you.

(Question read by the Reporter.)

XQ. 163 Was it or wasn't it.

A. No.

XQ 164 Did you ever try sulphur dioxide in the defendant's refrigerators?

A. No.

XQ. 165 Never have?

A. Not myself; it has been done, I suppose—I don't know of any time it has been done, I was not interested in it at all.

XQ. 166 You are sure it has never been done?

A. No, I wouldn't say that because there are dozens of other machines today—

XQ. 167. No, if you will wait and then answer the question and I will put it to you, and we will get along a good deal faster. What I am asking you is this: Isn't it the fact that in the defendant's plant or laboratory or somewhere about the defendant's establishment the defendant's refrigerators have been tested with sulphur dioxide?

A. Certainly not to my knowledge.

XQ. 168 Now, in the operation of the defendant's household devices, as they were used in service, isn't it a fact that at times the condensing coils filled almost to the top with liquid?

A. No, we do not put that much in there, so therefore it could not fill, only about 14 ounces of liquid in the outfit. I might say that six coils will hold all the liquid in there.

XQ. 169 So, there are times when substantially all the charge is liquid, are there not?

A. Well, liquid and gas, of course.

XQ. 170 You have said six coils will hold all the liquid?

A. Correct.

XQ 171 And on this diagram which you say you got up to explain to your school, or whatever it is, you show the dark red of the full six inches, and doesn't that mean that all the charge was liquid?

A. Well, that thing was not made up to be a statement of accurate proportions, as I have explained, it is diagrammatic, and as you will observe, the whole thing has no sense of proportion there at all. For instance, the compressor is a good deal bigger than the brine tank; it is diagrammatic.

XQ. 172 How many more coils on the returns are shown on this condenser coil than are shown in plaintiff's exhibit 7?

A. I wouldn't know that.

XQ. 173 Then we cannot take that as correct?

A. Only as a diagrammatic proposition.

XQ. 174 If that were a correct representation then all the methyl chloride contained would be in liquid form, wouldn't it?

A. No, if that were correct the lighter line would show the gaseous part of the methyl chloride and the dark red would show the liquid. As I tried patiently to explain before, that was not intended to be an absolute proportional proposition as I say, it is diagrammatic and expresses the idea rather than the quantities.

XQ. 175 Now when you got along with your examination this morning you were reading, I think from some typewritten papers, after you had got through reading from the service manual. What were the typewritten papers?

A. Some notes I had made to refresh my memory.

XQ. 176 Quite a number of them?

A. Well, not so many.

XQ. 177 Which had been gone over with your lawyer?

A. Oh no, he never saw them before.

XQ. 178 I understood you to say that you were in charge of the defense of the case. Do you want to qualify that?

A. Surely, in the way you apparently wish to take it.

XQ. 179 I am not taking anything, sir, I am asking you, do you want to qualify that statement that you are in charge of the defense of the case?

A. Yes, I do. I have represented the company in its contact with the attorneys, and represent the company in that, and in so far as that I am in charge of it.

XQ. 180. Did counsel pick you to make the lecture, or did you volunteer to make the lecture for counsel?

A. Well, I don't remember the details of that.

Mr. Frye: I object to that as immaterial.

Mr. Cooper: I think I am entitled to show how far this gentleman is in charge of the defense of the case.

XQ. 181 Did you have something to say about the fact that in 1910, and 1910, electric current was not commonly used, that in your town gas even was rare for house lighting, and also to the effect that direct current only was used where electricity was available, and that alternating current was very rare. Are you sure that is a correct representation of the—

A. Well, as far as—

XQ. 182. Now will you wait a minute?

A. Surely.

XQ. 183 Are you sure that was a correct representation of the situation of the electrical business in 1910 as you are of everything else you have been testifying to here?

A. You misquoted me in one thing, when you say that alternating current was not available in the towns, I did not say that, and it was not true.

XQ. 184 I did not intend to say that I will have the question read.

(Question read by the reporter.)

A. You misquoted me in saying the year 1910. I lived in Detroit in 1910.

XQ. 185 I will put it again this way: Do you dispute the fact that direct current and alternating current were generally available for practically everything in the entire United States outside of the villages in 1910?

A. I certainly do, and I can tell you where in Detroit that is the case even today.

XQ. 186 That neither direct or alternating current is available?

A. I didn't say that. I am confining it to certain districts, that certain districts have direct current and certain alternating in down town Detroit; you can only buy direct current unless you take it in large amounts.

XQ. 187 Let us go back to 1910. Was there not in every city practically of the United States of about 10,000 inhabitants, electric current available either as direct or alternating current?

A. I have never been in every town and I don't know.

XQ. 188 So you disqualify yourself on the condition of the electric business in 1910, do you?

A. I maintain you are misquoting me in the date of 1910.

XQ. 189 What date do you say then that alternating current was very rare and direct current only used?

A. Well, I said in my direct examination that in 1900 in the town where I lived that that current—

XQ. 190 I am not asking you about that at all. You make the statement that at some time direct current only could be used and alternating current was rare?

A. Well, I don't remember making that statement as you quote it.

XQ. 191 Then you say that is not so?

A. I don't know whether it is so or not.

XQ. 192 Well, when do you say that direct current only was available in the United States?

A. I don't know the exact date.

XQ. 193 When do you say that alternating current was very rare?

A. Shortly after—alternating current was very rare, for instance, in 1876, I know that.

XQ. 194 How old were you in 1876?

A. Well—

The Court: Well, ask him his age.

The Court rebukes Plaintiff's Counsel.

Mr. Cooper: Well, I think the witness has exhibited a very flippant attitude about this thing.

The Court: Well, you have too. I don't like this style of examination.

Mr. Cooper: Well, I very seldom resort to it, if the Court please, but the witness, as I took it, has stated that some time only direct current was used, and alternating current was very rare, and I want to know when that was.

The Court: I don't think he was born in 1876.

Mr. Cooper: He introduced that, if your Honor please.

The Court: No, you introduced it.

Mr. Cooper: Not the 1876, I beg your pardon.

XQ. 195 When do you say that direct current was used and alternating current was very rare?

A. I have read that at the Centennial in 1876 an alternating machine was on exhibit as a curiosity; Mr. Edison, I understand, even said that at that time it could not be used, in fact.

XQ. 196 Well, you made some statement, as I have it in my notes, that up to a period, or up to some date there was a lack of cheap and reliable electric power. At what date did you have in mind in respect of that?

A. About 1900 I think I spoke of that that electrical power has continually grown cheaper, even in the last ten years.

XQ. 197 When do you say that universal electric motors, that is usable on direct or alternating current for small units were first available?

A. I don't know, I simply spoke that they are available now.

Further discussion of the Audiffren machine.

XQ. 198 Now, you have spoken of an Audiffern machine. Does that diagram illustrate that machine?

A. It illustrates one type of the Audiffren, I would say.

XQ. 199 Is this a type that you had in mind in your testifying as to your knowledge of it?

A. I think that is a water cooled type.

XQ. 200 Well, let us get the water cooled type. This thing off to the right on this diagram, is a brine tank, isn't it?

A. I don't know, it looks like it. it is diagrammatic of course. It looks like a brine tank.

XQ. 201 You see a pipe marked "Brine"—"Brine return", so it is undoubtedly a brine tank.

A. I think it is. yes.

XQ. 202 And there is what seems to be an electric motor driving what is designated as a suction pump?

A. Correct.

XQ. 203 And that draws brine out of this tank?

A. Yes, sir.

XQ. 204 And pumps it up to a refrigerator which appears to be on the floor above the installation we are looking at?

A. That so appears.

XQ. 205 And here is a motor which is belted to the other machinery?

A. To the shaft, yes.

A. Yes.

XQ. 206 And on that shaft, as I understand it, there are two rotary members, one inside of the brine tank, and one outside of the brine tank?

A. Yes, sir.

XQ. 207 And one of those rotary members has attached to it a water supply?

A. Yes, it is so marked.

XQ. 208 And the part that is marked "Water supply" is what? A compressor or condenser?

A. Both.

XQ. 209 That is both compressor and condenser?

A Yes, sir.

XQ. 210 And that thing looks like a ball, as shown here?

A. Yes.

XQ. 211 And that comprises a metallic shaft which was rotated or turned over and over?

A. Correct.

XQ. 212 And in that shaft, that rotating shell, was a relatively stationary compression pump?

A. Yes.

XQ. 213 That is, it reciprocated back and forth, but it did not turn with the shell; that is, the shell turned about?

A. Yes, turned about.

XQ. 214 And after compression and expansion—after compression the expansion was in the same chamber?

A. It certainly is not.

XQ. 215 How was the expansion?

A. Well, I have a diagram there I can show you if you will refer to the Audiffren patent. I cannot show you there except that it is over here.

XQ. 216 I thought you said that the expansion was in this left hand—

A. That was your statement, I said it was not.

XQ. 217 Oh, I beg your pardon.

A. Yes.

XQ. 218 The member on the right that is in the brine tank then is the expansion chamber or cooling coil, or what do you call it?

A. Well, it depends on what you want to call it. I would say evaporator. If you wish to call it expansion—

XQ. 219 I would like to use your term for it.

A. Well, we will say evaporator then.

XQ. 220 All right. There was a compression of S02 and an expansion, which cooled brine?

A. Yes.

XQ. 221 And that brine was pumped up into the household refrigerator.

A. Yes, sir, sure.

XQ. 222 And then returned to the brine tank where it was re-cooled?

A. That is one application you are showing there.

XQ. 223 Now in this machine as shown here there is also another refrigerator or cold room?

A. Yes.

XQ. 224 And that is similarly supplied with the brine cooled in this way?

A. Yes.

XQ. 225 In this machine was there a compression of the refrigerant to liquid form?

A. That occurs in no machine that I know of. It is worked on exactly the same principle as the two machines here. The gas was, first of all compressed, and then the heat of compression was removed from the condenser shell here, and there is nothing different in principle in this than the machines here as far as refrigerating—

XQ. 226 My point is, is the condition of the refrigerant at any time in liquid?

A. Absolutely.

XQ. 227 It was, in Audiffren's patent?

A. Certainly certainly, it is so stated in their patent.

XQ. 228 In this the heat of compression was removed by the water supply?

A. Yes, that is a water cooled machine

XQ. 229 And do my eyes deceive me when I seem to see on this that the machinery for cooling, including the water tank, is larger than the refrigerator on the floor above?

A. This is diagrammatic. I don't think your eyes deceive you, but I think the installation is not in accordance with the diagram any more than that diagram is in step with the installation; it is purely diagrammatic.

XQ. 230 Here on another page of this bulletin is what we can take as a cut of the mechanic's, including the brine tank and the other tank, and the two rotating shells with an indication on the left hand side of one of the pumps and on the right hand side the shafting for driving from the other motor.

A. What other motor? You mean from a motor?

XQ. 231 Yes, from a motor.

A. Yes.

XQ. 232 That is, according to the diagram there was a motor for the pump and a separate motor for the shafting?

A. Yes.

XQ. 233 Have you any knowledge of what one of those units costs?

A. Not direct knowledge, but I heard that they cost, one of the particular size I knew—I have heard of, I mean, without knowing that size, to run up to $1,500.00.

Mr. Cooper: I will have these pages marked for identification.

(Pages marked "Exhibits 15 and 15-A" by the reporter.)

The Court: We will now adjourn until 1:45 P. M.

(Thereupon a recess was taken to 1:45 o'clock P. M., same day, Wednesday, March 20, 1929.)

Cross-examination of Witness Harry C. Hayes on experience in building and operating refrigeration plants.

Afternoon Session

Wednesday, March 20, 1929.

1:45 o'clock, P. M.

Court convened pursuant to recess.

Harry C. Hayes, a witness called on behalf of the Defendant, thereupon resumed the stand and having been previously duly sworn, testified further as follows:

Cross Examination (Continued)

By Mr. Cooper:

XQ. 234 You spoke of your experience with a company that I took as the Independent Ice & Fuel Company of Richmond, Indiana, about 1900 to 1904.

A. Yes. Not 1904—prior to that time, I think you will find it.

XQ. 235 From 1900 to 1904 was the way I took it.

A. Oh yes. that is correct.

XQ. 236 How big was that machine?

A. Oh, that was a small commercial outfit, about 15 tons, I should say.

XQ. 237 That is, that was to manufacture 15 tons of ice per day?

XQ. 238 And that was an ammonia plant?

A. Yes.

XQ. 239 You spoke of the plants of the Peoples Ice Company?

A. Yes.

XQ. 240 Where were they located?

A. In various parts of Detroit—well, the principal was at Warren and Dequindre Street, Detroit, Michigan.

XQ. 241 And that was the plant that produced about 350 tons of ice per day?

A. Of refrigeration at that time.

XQ. 242 Oh, that was a cold storage plant?

A. No, it was an ice making plant, but I expressed the size in terms of refrigeration. There is a little difference between that and ice making. That plant made about 200 tons of ice at that time, however.

XQ. 243 Per day?

A. Yes.

XQ. 244 Now, that was the plant, and the one at Richmond, Indiana, was another plant, using ammonia as a refrigerant?

A. Yes.

XQ. 245 In which the condensing apparatus was up on the roof?

A. Yes.

XQ. 246 And there you pumped up water and sprayed the water over these tubes which were lightly, if any, enclosed in boxes and the like, is that it?

A. No, they were not enclosed at all in a box, they were simply standing in

(Continued on page 36)

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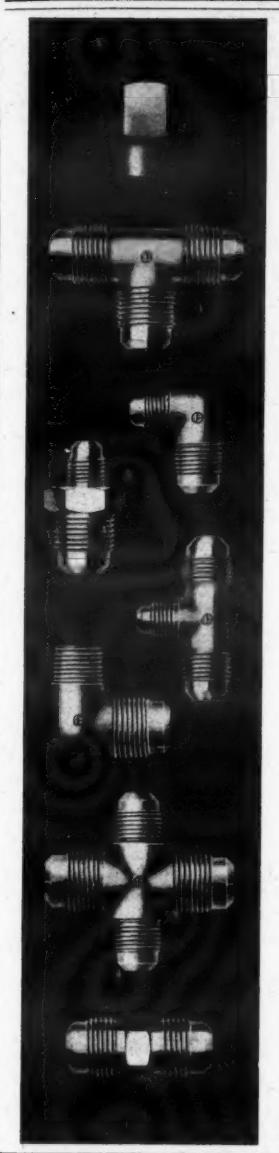

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Construction of the Condenser

stands on the roof in the conventional way.

XQ. 247. And water was pumped and sprayed out over those pipes in summer, I believe you said?

A. In summer time; yes, sir.

XQ. 248 Now, take for example the plant of the Peoples Ice Company, how much ice did it produce per day in winter? You mentioned the fact that its production was decreased in winter?

A. Well, at that time it was according to demand. It was a comparatively small amount, I should say; well, it might have been a hundred tons some days, 50 tons some days and some days not so much. Some days it did not run at all in the winter time.

XQ. 249 So that with reference to that winter production at the low rate, the condenser, in a way of speaking, was larger than was required?

A. Oh, yes.

XQ. 250 And hence it did not require any water cooling such as was necessary when it was up to the capacity for which it was designed?

A. Yes, and also because of the fact that in winter time the temperature difference between the outside air and the condenser, of course, was very much greater than in the summer time.

XQ. 251 How much water was required for the ice plant in the summer time?

A. We were pumping about five gallons of water per minute per ton, not water thrown away, but pumped over that, and then recirculated to the cooling tower.

XQ. 252 So you would have to have something on the order of a thousand gallons per minute, and that re-circulated would require what power for the pump?

A. To handle a thousand gallons—it it pretty hard to remember that right now, I would say probably about 50 horsepower in the aggregate.

XQ. 253 Something of the same order of magnitude for the plant at the Independent Ice & Fuel Company at Richmond?

A. It was a much smaller pump, a very much smaller plant, I should say in proportion as 15 was to 200, something like that.

XQ. 254 The Richmond plant was not one for—that was the plant where there was only 15 tons produced a day?

A. Yes, sir.

XQ. 255 You spoke of having had to do with many plants up to 600 tons a day?

A. Yes.

XQ. 256 So that in that sense, was it in the sense of being an operator or as a construction man?

A. Well, both. I built the plants and they were operated under my supervision—I didn't open the valves, and so forth, but I was in charge of it.

XQ. 257 Where was the 600 ton plant?

A. At the site of the plant I first spoke of on Warren Avenue, it is still such, the plant has been added to, and it is a big plant now.

XQ. 258 How much horsepower would you need to pump the water for the condensing coils on that one there?

A. I don't know. They have several pumps, I don't remember just the aggregate horsepower now, I could calculate it, but I don't remember off hand.

XQ. 259 And the same gallonage per ton of production all through it would be?

A. Yes, but remember now, the 600 ton is of course refrigeration, I am talking of that.

XQ. 260 Yes, I understand, 600 tons of refrigeration would be about equivalent to two-thirds of the tonnage in production of the ice?

A. About that, I should say, offhand, roughly.

The Court: What do you mean by refrigeration of ice, as to that?

The Witness: To produce a ton of ice—in the first place a unit of refrigeration means the refrigeration that is taken up, the heat unit taken up in the melting of a unit of ice. A pound of ice takes up about 144 B. T. U.'s to melt, and a ton being 2,000 pounds, the refrigerating then is 288,000 B. T. U.'s in a day of 24 hours, or about 200 B. T. U.'s a minute. To make that ice, however, to get it in shape to take up that much we have to do more than that in the way of work. We have to cool the water possibly from 75 to 32 degrees, and you have certain losses like radiation, heat leakage and so forth that accounts for the difference.

XQ. 261 You spoke of your familiarity with copper tubing of various sizes, and also said that copper tubing was a standard article ahead of 1913?

A. Yes, sir.

XQ. 262 In what sizes?

A. Well, may I refer to a note on that?

(Witness refers to memorandum.)

XQ. 263 If it refreshes your recollection of course.

A. It will. I have a price list here dated May, 1909, and the sizes are given 1-32, 3-32, 5-64—

XQ. 264 Ranging up to what?

A. From 1-32 up to 1 inch.

XQ. 265 Of copper tubing?

A. Yes, sir.

XQ. 266 And all those you were familiar with in 1913 are ahead of that?

A. Yes, I don't think I ever saw—

XQ. 267 But you were familiar with the fact that those were procurable during all of that period?

A. Yes.

XQ. 268 And for many years before 1913?

A. Yes.

Discussion on the construction of the Flintlock Condenser.

XQ. 269 Now in connection with some statements you made regarding the various types of household refrigeration of today, you stated that in some constructions which you have mentioned they are not using tubes for the condensers in the instance of the product which you designated as the Flintlock, that you obtained by arranging plates of copper or brass for an extension is left?

A. I see.

XQ. 270 And then these pieces are stacked together. You recall that construction?

A. Yes, I do.

XQ. 271 When it was assembled the effect is a continuous pipe with fins?

A. It is a continuous opening, I would not call it a pipe, it is an opening continuously.

XQ. 272 And of course those fins are so assembled that there is no leakage of the refrigerated gas?

A. That is correct.

XQ. 273 So that in practical effect it is a pipe with fins although not made as a pipe in the first place.

A. That is true, but on the inside of the Flintlock is an obstruction at each and every piece that is punched, the piece that is presumably punched out to make the hole is deliberately left in after it is closed up, it is closed a little, and this piece is left in it and forms a partial restriction in there. The purpose of that was to conduct heat more rapidly from the center to the outer wall of that, so it is not a pipe in any sense, I would say.

XQ. 274 Now, these little projections, if I may use that term, that are left as you have described, register with one another?

A. No, they don't touch each other inside, they are very close together, however, but they do not touch each other, that is, if you mean—you mean the obstructions left inside of the tube?

XQ. 275 Yes.

A. No, they don't touch each other.

XQ. 276 These pieces that are left in register with one another so they would have a uniform projection, so to speak, into the orifice?

A. No, I don't think that could happen, because the punching might be uniform, but if the things were stacked, the sheet is square from which it is punched and one might be vertical, so there would be no uniform passage through there, guaranteed, at least; I believe it might be in some instances, other instances not.

XQ. 277 Have you a sample of that Flintlock stuff here?

A. I think we have.

XQ. 278 May I see a piece so we will know what we are talking about.

A. It is in a condenser generally.

XQ. 279 This is the Flintlock construction as you use it in some of your refrigerators with all the parts assembled?

A. Yes, sir.

XQ. 280 Can any of us look so as to see what these obstructions look like?

A. Not unless you cut it in two.

XQ. 281 As I look at it laterally it looks like the construction that is exemplified in Plaintiff's exhibit 13. Don't you find it that way?

A. As far as outside appearance is concerned, yes.

The Court: I understand that pipe is made out of this size bent down.

The Witness: Yes, I will be glad to show you how that is. Each one of these is punched.

XQ. 282 Would you just illustrate on this sheet of paper?

How the parts are punched.

A. Here is a flat piece. That is first cut, looking down on top of it, there is a punch that goes through there at one operation, that first fits something like this, makes a cut there, leaving part of the attachment. As the punch goes down still further, looking now along the edge of the sheet, the result is something like this. Now, the piece is never cut altogether from here, but as the punch goes down it turns this piece over until it looks like this, remaining attached at this point.

Now, therefore, looking this way at the foot that piece is in there in this fashion, or looking the other way it appears in this shape through there, something like that, and attaching to this end. Now, in making that up, the next piece is stacked in this fashion, and the next piece here, and so forth. There is an actual hole through there, right here, by these pieces, if you can think of it in that way. Here is the punched out piece, it is not entirely punched out, but closed up now, and we have an opening through here and through here.

XQ. 283 I will just put on the sheet that you have my best effort of making a circle, which is supposed to represent the hole looking through there. Now will you add to that circle what you understand to be this projection on the inside?

The Court: It serves the same purpose as a fin, as I understand it?

The Witness: Yes, it does. Let us see, it represents something like that.

XQ. 284 So when you look through there you see a sort of double hole, do you, one through the fin?

A. Yes, if you are looking at one of these only.

The Court: Isn't that thing put on down through there?

The Witness: No, sir, this elbow is soldered on, your Honor. It is slipped down inside of that.

The Court: And is that what looks to me like a tube in there, just the thickness in those little things?

The Witness: Yes, your Honor.

XQ. 285 I suppose if the valves are open, cold can flow through this just like cold through a tube?

A. Well, if the tube had obstructions, partial obstructions in it, yes.

XQ. 286 Partial obstructions?

A. Yes.

XQ. 287 It has to be free enough so that the gas flows through under the pressure that is used?

A. Yes, sir.

XQ. 288 And how much difference is there between these external bends that we see here and 3-8 of an inch, do you think?

A I don't know. We can measure it, I guess.

XQ. 289 You do not happen to know?

A. No, I do not.

XQ. 290 It must be approximately that?

A. I think it is about a quarter of an inch, about.

XQ. 291 Well, I think a little bit more.

A. I think it is quarter inch tubing.

(The bends in question were measured at this point by Mr. Sessions.)

Mr. Sessions: It is 3-8 of an inch in that direction.

The Witness: Take it this way, please.

Mr. Sessions: I will take it that way, and I want to take it this way, also. It is 5-16 and 1-32—11-32 where it is telescoped on to the punching.

Mr. Cooper: Do you mind if we take another one that has been flattened off there?

The Witness: Certainly not.

Mr. Sessions: 9-32 in the vertical direction.

Mr. Cooper: At the top of the arch?

Mr. Sessions: Yes, probably 1-4 inch.

Mr. Cooper: I will mark for identification this Flintlock condenser.

Mr. Frye: Also the sheet, Mr. Cooper.

Mr. Cooper: Well, I will mark the sheet for identification, too, though I don't know how understandable it will be.

(The Flintlock condenser and the sheet were respectively marked "Plaintiff's exhibits 17 and 18" for identification.)

XQ. 292 You have spoken of a good many different household refrigerators, refrigerating machines, by name. I will ask you if you ever heard the name of Isko on household refrigerating machines?

A. Yes, I have.

XQ. 293 Was that as of about the period of 1918 or thereabouts, an air cooled machine?

A. I don't know. I saw one at what possibly was a later period, and I do not really remember at that time whether it was air or water cooled.

XQ. 294 Did you, among other devices, know one designated the Domelre, put out by the Domestic Electric Refrigerator Company?

A. I have seen advertisements of that machine. I never saw one.

XQ. 295 Was the advertisement of that machine one of those that you testified about in your direct examination?

A. I saw some such advertisement, yes.

XQ. 296 Do you recognize this as it?

A. It looks like it, yes; so marked and so forth.

XQ. 297 This is from the Ice and Refrigeration of March, 1914?

A. Yes, I was reading a paper at that time.

XQ. 298 So that you think you saw it at about that time?

A. Yes.

XQ. 299 Was that an air cooled machine?

A. That advertisement so shows it.

XQ. 300 Yes.

Mr. Cooper: I will have this marked for identification plaintiff's exhibit 19.

(The advertisement referred to was so marked.)

XQ. 301 Was the Isko machine of this same general appearance as the Domelre?

A. Well, I think it was. They all look more or less alike. I don't remember the details of it, but I imagine it was.

XQ. 302 And it was an air cooled machine, too?

A. Oh, I testified a while ago that I did not remember whether it was air cooled or water cooled?

XQ. 303 Now, you said something regarding the proper construction?

A. Proper what?

Questions regarding size and thickness of condenser pipe.

XQ. 304 Construction or theory of construction in a condenser in a refrigerating machine. I think you did not take into account, as far as your statement went, of the velocity of the gas through the condenser, and I will ask you to answer the question whether the velocity of the gas through the condenser has any necessary relationship to the proper proportioning of the condenser? Would that have to be taken into consideration?

A. Only to be sure about pipe, big enough so that the gas is not restricted in flowing through. After having that, it is not an important thing.

XQ. 305 Then, if the pipe were big enough to take the gas through, it would not make any difference whether it were 3-8 or 1 inch?

A. No.

XQ. 306 Provided you had sufficient pipe surface, is that your position?

A. That is correct, or even larger.

XQ. 307 It might be much larger?

A. Correct.

XQ. 308 For a household refrigerator, might it be five inches?

A. It could be, if you wanted a short condenser, five inches in diameter.

XQ. 309 Or even ten?

A. Well, if you have got room in the box to get it in there.

XQ. 310 Provided only you were to have the same surface on your big pipe that you would on the 3-8 inch pipe, for example?

A. Yes, and provided, of course, it is exposed to the same influences a 3-8 inch was exposed to.

XQ. 311 Now, would the thickness of the wall of the pipe have anything to do with it?

A. Yes, sir; if you had it too thick, obviously it would not transmit heat so rapidly, which could be overcome by additional surface, of course.

XQ. 312 Just one moment more on this plaintiff's exhibit 17. Those units are copper, are they tinned?

A. I think they are brass.

XQ. 313 Brass, tinned?

A. Yes.

XQ. 314 And brass, speaking generally, has the same lack of affinity, if that is a correct term, to the ordinary refrigerants that copper has?

A. Generally, yes.

XQ. 315 And in that respect, both differ from iron and steel, for example?

A. No, I would not say that.

XQ. 316 That is, you could not use this brass for ammonia, for instance?

A. Yes, I could that, because it is tinned?

XQ. 317 Because it is tinned?

A. Yes.

XQ. 318 And if it is thoroughly tinned on the inside, you could?

A. Yes, they are all tinned, first.

XQ. 319 And of course, if there were a pin point size that was not tinned, then the trouble would begin, wouldn't it?

Brass parts used successfully in ammonia machine made by Climax.

A. Not necessarily, if oil was on it; of course, it keeps away the action of ammonia. There is a machine on the market right now, known as the Climax, that does have the brass and uses ammonia, but the brass parts are covered with oil more or less and they seem to get along all right.

XQ. 320 But at any rate, as chief engineer for your company you have not yet prescribed steel or iron?

A. Rather difficult to work, so I have not prescribed it for pipes.

Mr. Cooper: That is all.

Mr. Frye: Mr. Cooper, I desire to have marked for identification the handbook, whatever it is termed, that you refer to, the charts used by the witness, one of them being a cross section—

The Court: Hadn't you better take them up and let us know what number they are?

Mr. Cooper: If you will go ahead and have them marked for identification, I have nothing in the world—

Mr. Frye: I thought perhaps you would like to cross examine on them. They have not been offered. Exhibit 20 would be—what is the title of that book?

The Witness: Service manual.

Mr. Cooper: That you are marking for identification?

Mr. Frye: Yes, that is it.

21 would be the diagrammatic chart showing the Absopure System in sections; I suppose that is the best way to describe it.

The Witness: Yes, sectional diagram.

Mr. Frye: And 22, a chart showing a cross section of the evaporation, model B 52 of Frigidaire; and I should say collectively, as 23, the various periodicals which the witnes has now picked out as having formed the subject matter on which his testimony was based, in the direct testimony.

List of magazine articles and advertisements which are entered as exhibits by the Defendant.

Now it happens that some of them, we have the photostats in, but in the instance of 5 we have not, so we would like permission to substitute photostats as soon as they are obtained.

Now, those, to list them in the record, are:

Ice and Refrigeration, issue of November, 1897, page 325, an article called "The small machine."

The same magazine, February, 1908, an article called "Refrigeration at the electrical show," page 62.

The same magazine, April 1904, page 250, an article describing a novel refrigerating apparatus, with pictures of the Audiffren device.

The same magazine, December 1908, page 312, the first paragraph beginning in the second column on that page, headed by the title "Condensers and expansion piping."

The same magazine, March 1894, page 174, paragraph in the second column is marked, which leads with the wording, "The comparative values of submerged condensers and those which are exposed to the atmosphere."

The same magazine, November 1896, page 315, an article entitled, "The small machine."

The same magazine, March 1900, page 274 an advertisement of the Automatic Refrigerating Machine.

The same magazine, November 1901, two advertisements, one of the Hunt Air Brake Company, the other of the Singer Automatic Ice Machine Company, page 43.

The same magazine, August 1904, page 55, an advertisement called "The Twentieth Century Refrigerating Ice Machine," and a second advertisement on the same page entitled the "Best small compressor."

The Court: The best what?

Mr. Frye: Small compressor. He has two check marks there, so I am calling attention to both.

The same magazine, September 1904, pages 89 and 90, being a photograph and description of a Brunswick Refrigerating Plant.

The same magazine, January 1908, page 71, an advertisement of the Clothel Refrigerating System.

The same magazine, April 1913, page 9, an advertisement of the Johns-Manville

(Continued on Page 37)

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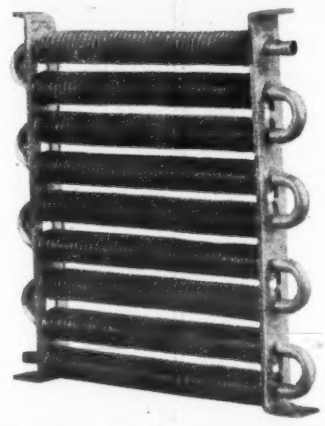

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H. R. Van Deventer Testifies as Expert Witness for Defendant

Company featuring the Audiffren-Singrun Refrigerating Machine.

The same magazine, November 1895, page 325, an article entitled, "A new small machine."

The Court: Is there any order to those?

Mr. Frye: I took them as the witness selected them. I will be glad to put them in as one bunch when we get the photostats.

There is one more, the same magazine, February 1896, page 134, an advertisement of the Economical Refrigerating Machine.

Now, your Honor, that is to be marked as one group, for identification only. In this regard, we would like to say there is one other paper that we think ought to be marked although it was not in my examination. That would be the price list referred to, and if Mr. Cooper does not care to mark it, we desire to have it marked for identification, on the copper tubing used.

Now, that will have marked here everything he referred to, as far as I know.

Mr. Cooper: He did not refer to the price list.

Mr. Frye: Didn't you read from the price list of 1909?

Mr. Cooper: No, whose price list?

Mr. Frye: I don't know. I didn't look at it. I wanted to get it in, so we would all know.

Mr. Cooper: Oh, he did, on the copper tubing—I beg your pardon.

The Witness: The United—

Mr. Frye: I move to have it marked for identification.

Mr. Cooper: You can have anything you want marked for identification, so far as I am concerned.

Mr. Frye: You brought it up. If you do not want to then I thought I would.

Mr. Cooper: I am perfectly content to have the statement of the witness as to what this price list was.

Mr. Frye: Let us have it all in. Then there cannot be any question.

The Court: That will be exhibit 24.

Mr. Cooper: Thank you for the compliment. If I say now that I will not raise a question, I never will hereafter.

Mr. Frye: That is not the point at all; and I would like the same indulgence about giving copies by photostats and so forth. We will do it at the earliest possible moment.

Now, I put that in before redirect, because if you want to ask anything, we will be glad to hold ours.

Redirect Examination

By Mr. Frye:

RDQ. 321 In your cross examination the question was asked you concerning the defendant's machine, and you stated it was purchased from a predecessor, and that you did not design it?

A. Oh, no.

General Necessities Corp. bought machine from Iceless Refrigerator Machine Co., of Detroit.

RDQ. 322 Will you tell us the name or names of such predecessor company?

A. The party from whom we bought it was known as the Iceless Refrigerator Machine Company of Detroit, and its predecessor was the Kold-King.

RDQ. 323 Did both of those companies manufacture an air cooled refrigerator?

A. Yes, sir.

RDQ. 324 Substantially like the one being made by you, except for refinements?

A. Yes, practically the same thing as that of our machine.

RDQ. 325 Do you know when the earlier of these companies, the Kold-King, reached the market?

A. About 1922 I should say.

RDQ. 326 Now the question was asked you concerning the conduct by you in this lawsuit and whether you volunteered as a witness?

Mr. Cooper: I didn't ask him such a question.

Mr. Frye: That is what I understood it to be. Excuse me.

RDQ. 327 Will you tell us whether or not it was your intent, and you personally helped counsel to obtain the chief engineer of another company?

Mr. Cooper: I will object to this, I cannot see the competency of that question.

The Court: I don't think it is competent or I don't think it is of any importance.

Mr. Frye: What I mean is this, your Honor, that up to three days before the trial we had this prepared for another witness, and very suddenly we had to get a witness, and I personally instructed this witness to try to prepare for it.

Mr. Cooper: I will take counsel's statement on that.

Mr. Frye: All right.

The Court: I will too.

Professor Wagner, killed in automobile accident, was to have been witness for the Defendant.

RDQ. 328 Will you also tell on the record whether when previous counsel was in the case there was an expert who was in touch with you and who was killed in an automobile accident?

Mr. Cooper: I will concede that fact, the death of Professor Wagner was a great blow to me, and I heard he had been obtained for the defendant.

RDQ. 329 Now let us return to the Audiffren machine about which questions were asked. I call your attention to U. S. Patent Number 898410 and ask you if that is one of the Audiffren patents which you had in mind?

A. Yes, sir.

RDQ. 330 Now will you use that refresh your recollection and tell us whether or not the refrigerant goes through substantially identically the same cycle as that explained by you in connection with the defendant's and plaintiff's machines?

A. Identically.

RDQ. 331. Will you read, quoting the line where the patent says that the refrigerant is liquefied after being compressed?

A. On page 1, line about 13 or 15 it reads: "Consisting of a rotary condenser in which are one or more compressors of liquefiable gases, such as sulphuric acid, and any convenient form of evaporator or refrigerant."

Then on page two, lines about 112, the latter part of the lines: "These vapors of gases are thus compressed by the pumps to the compressor, and are finally liquefied."

That is all relating to that.

RDQ. 332 Now will you tell the Court the purpose of the fan marked "7" as you find it in the specifications?

A. The purpose of that fan is to cool the condenser.

WITNESS

H. R. Van Deventer

The Court: That is September 8, 1908?

Mr. Frye: Yes, your Honor.

RDQ. 333 In what manner, by blowing air or drawing air, or what does the specification say?

A. The specification reads: "This hood is provided with a shaft, 6, furnished with a ventilating fan, 7, driven by the machine shaft, in any convenient manner, with openings, 8, for the circulation of the air."

The Court. What is meant by "rotary"?

The Witness: A turning member.

The Court: It means the whole machine rotates?

The Witness: Yes, this whole machine has that peculiarity.

RDQ. 334 Well, does the condenser of the Audiffren machine rotate?

A. Yes, sir.

RDQ. 335 And is it contacted with air?

A. It is.

RDQ. 336 Drawn in by the fan, 7?

A. Yes, sir.

RDQ. 337 And is there water at the lower extremity into which the condenser may dip as it rotates?

A. It is shown here; yes, sir.

RDQ. 338 Now would you, as an engineer, call that an air cooling device?

A. I surely would, because the heat is conducted away in the air.

RDQ. 339 Suppose water in the well there, entirely evaporated and was not replaced, would it still operate with air only?

Mr. Cooper: I think the witness has not shown any competency as to that. I didn't hear him say he had examined one of those plants.

RDQ. 340 If you know, of course?

A. Why, I surely know. It would continue to operate just as any condenser would operate, although not quite so efficiently, in other words, it would take longer to do the same work and it would do it without the aid of water.

RDQ. 341 But as an engineer, skilled in refrigerating matters, looking at the disclosure before you, would you give it as your opinion that it will operate with water and air, or with air alone?

A. Yes, sir.

RDQ. 342 Now as a refrigerating engineer, would it be possible for you to, without particular trouble, design the condenser so as to be always operated with air alone?

A. Yes, sir.

RDQ. 343 What, for example, would be necessary to be done?

A. To make this one larger, give it more surface, probably to have the fan in a little more advantageous spot, possibly a larger fan than you have there.

RDQ. 344 And when you say this one you art pointing to the condenser?

A. Yes, I mean—yes, I am pointing to the condenser, to make a condenser designed to operate with air, one with more surface than one designed to operate with water, or a mixture of water and air.

Mr. Frye: That is all.

Recross Examination

By Mr. Cooper:

RDQ. 345 Where have you seen one of these Audiffren machines in which the part that you have designated as the condenser was operated without contact with a body of water?

A. At New York.

RDQ. 346 You have seen it operated there?

A. I was shown such a thing, yes.

RDQ. 347 When?

A. Oh about—let me see—I don't know, about three or four years ago I should say.

RDQ. 348 That was just like this drawing, was it?

A. I didn't see any particular difference that I noticed. I couldn't say it was just exactly like it, it was mounted in the bottom of the refrigerator, and I took no minute examination, made no minute examination of it.

RDQ. 349 As a matter of fact, wasn't it one that had been designed by the company not long before you saw it, as an air condenser?

A. I don't know who designed it.

RDQ. 350 I did not ask you who designed it.

A. I beg your pardon, sir, I thought that is what you said.

RDQ. 351 Didn't they inform you that was one designed some time before you went there as an air condenser?

A. I don't remember that information, I might have.

RDQ. 352 Well, in your intimate contact with all this advertising matter, don't you remember that they announced an air cooled Audiffren type of machine some time after 1920?

A. This is the only announcement I ever saw of an air cooled Audiffren.

RDQ. 353. When you read from the specification, page 2, beginning line 90, you did not read quite as much as I would like to have you read, so I will ask you to listen to what it says about the matter of air, while I read it: "This head is provided with a shaft, 6, furnished with a ventilating fan, 7, driven by the shaft of the machine in any convenient manner, and with openings, 8, for the circulation of the air; the air passing across water in a finely divided state, caused by the rapid rotation of the condenser, effects a considerable cooling of the water, and consequently a reduction of the amount of water required for condensation."

You observe that now that I call your attention to it?

A. I surely do.

RDQ. 354 Also what succeeds that: "Also the air drawn in by the fan (Lines 100-105), 7, and that the openings, 8, at the opposite side of the casing, 5, and is cooled to a considerable extent by being drawn over the evaporator, C. This, of course, aids considerably in cooling water sprayed from the rapidly rotating condenser." You observe that?

A. Yes, sir.

RDQ. 355 If you look at figure 1 you will see that what he designates there as the evaporator, C, is the cooling drum that is in a brine tank to the left of the evaporator, don't you?

A. Yes, sir.

RDQ. 356 So that this air that is drawn in to it, to specially cool the water for the condenser itself has to be cooled by being drawn over the cooling drum in the brine tank?

A. It certainly does not have to be cooled.

RDQ. 357 According to his statement that is what is done, isn't it?

A. It does not say it has to be, it said it is done. Of course, he was lifting himself with his boot straps when he did that, a little bit.

RDQ. 358 Yes, I agree that a good many of those proposals were lifting themselves by the boot straps besides Mr. Audiffren.

I think that is all.

H. R. Van Deventer, consulting engineer and patent attorney, testifies.

H. R. Van Deventer was thereupon called as a witness on behalf of the Defendant, having been first duly sworn, testified as follows:

Direct Examination

By Mr. Frye:

Q. 1 Will you state your name, address and occupation?

A. H. R. Van Deventer, 842 Madison Avenue, New York City, consulting engineer and patent attorney.

Q. 2 Will you state briefly the experience you have had in connection with engineering and refrigerating apparatus, and also in connection with patents, either as attorney or otherwise?

A. My experience with refrigeration began about 1906 and consisted of the defining and construction of compressors and evaporators, and the other component parts of refrigeration apparatus, the same being limited to the small or household type, and that continued for a number of years, until about 1914 or 1915, where it was temporarily suspended on account of events brought about by the war, and in 1919 I resumed the work I had been doing, and at that time became connected with the Westinghouse Electric & Manufacturing Company in their Bureau of Patent development. I was almost immediately assigned to the engineering and patent study of the refrigeration industry as it existed in connection with household machines, and during my three years connection with the company, devoted the greater part of my time to this work. This consisted in a study of the art as exemplified by United States and foreign patents, and numerous conferences with inventors and engineers, visits to the factories of the then existing companies manufacturing household machines, and certain experimental work being done by the company itself.

Upon leaving that company in 1922 or 1923 I resumed my experimental work in New York, having some private clients at that time, and later on organized a corporation which for the past three years has devoted itself largely to the development of household refrigerators.

My experience as an engineer has been largely confined to the so-called domestic appliance field. that is to say, washing machines, ironing machines, vacuum cleaners and other so-called domestic appliances, and my particular experience in the refrigeration field has been in connection with the small machines as used in households, and as are exhibited here in this suit.

I have for 15 years been a registered patent attorney, practicing before the United States Patent Office and for some years have been registered to practice in the Dominion of Canada. I am a member of the American Society of Refrigeration Engineers, the Society of Automotive Engineers, the American Institute of Electrical Engineers and several other engineering societies, and I am a licensed professional engineer in the State of New York.

Q. 3 Have you had occasion to study patents relating to the refrigerating apparatus during the pursuits that you have spoken of?

A. Yes.

Q. 4 Have you also been instrumental in building or selling or operating actual refrigerating machines?

A. Yes.

Q. 5 In your career as a patent attorney have you been called upon to give opinions regarding refrigeration patents, particularly the scope of claims or alleged infringements?

A. Yes.

Q. 6 Before going into the patents, I would like you to state generally for the benefit of the Court, the development of this so-called household machine with which you say you have been continuously familiar during your experience as an engineer, and enumerate if you can, the factors involved in the practical development as distinguished from the refrigeration theory. We have had it explained by others.

Quantity market for small machine attracted manufacturers.

A. Your Honor, I shall attempt to avoid what has been already said about refrigeration in general, and my statement will be in the nature of an explanatory statement rather than one containing any anticipatory matter. I will attempt to give your Honor a brief picture of the practical situation that existed at the beginning of this industry. The various factors that led to the development of the household refrigeration industry may be stated as follows: First the increase in use of the electric current in the home, and the thing that held the refrigeration industry back in the home for a long time was the high cost of that current and the high cost of electric motors necessary with the small refrigeration machines. I am stating only general facts. Second, the thing that brought about the creation of the industry was the desire of the ice machine manufacturers to find a new market for their product. It is quite obvious that there can be only one, or at least a few ice plants in a given town, whereas in a place of 25 or 30 thousand homes it is reasonable to suppose that a large percentage of those can be sold electric refrigerators, and the manufacturers naturally turned their eyes somewhat longingly toward that virgin field in building such a device.

Practical difficulties which retarded development of the electric refrigeration industry.

Now some of those practical difficulties, and one of the most serious ones to start with, was the construction of the compressor or pump which compresses the gas. Obviously, in those large plants which have been referred to by the prior witnesses, the cylinder diameters were sufficient to enable them to secure accurate fits, which would properly perform their work, but when these cylinder bores began to be reduced so they were an inch to two inches, great difficulty arose in making these close fits necessary. A reasonable cost of designing the proper valves and proper stuffing boxes so that the gas would not leak out around the shaft of the machine, and there were many other practical difficulties. The industry had no practical electrical controls, they were dependent on devices that were more or less crude and more or less expensive and their motors were to a certain extent crude, and they had no experience whatever in charging small quantities of gas into these machines. The larger machines used many pounds of gas, the small machine, such as on exhibition here, will use maybe a pound to two pounds of gas. The inside of the machine must be very thoroughly evacuated, and in some cases oil must be removed.

Now, the manufacturers had no experience in the mass production of the devices of this kind, and the industry proceeded slowly on its way until those

(Continued on Page 38)

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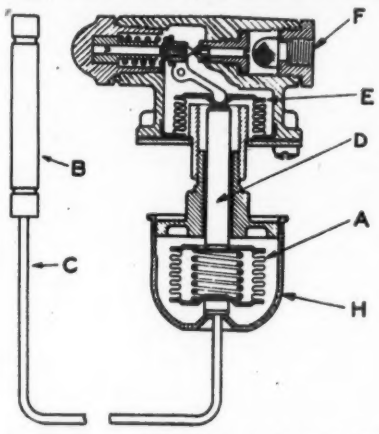

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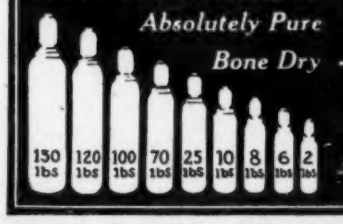

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Air and Water Cooled Equipment Compared

practical difficulties were overcome, the point being that the period of the household refrigerator industry was not due to the inventive genius of any one man or any group of men, but was a thing of slow growth. Many individuals contributed their share.

Now granting that all of these problems could have been solved, there was another very serious problem that held the industry back, and that was the question of service. They were going to place a machine into the home, which was supposed to operate continuously, and no company, except a very large company of tremendous resources, could hope to furnish the service necessary for that. What I mean by tremendous resources is a company which would, back in that day, be worth a million dollars or more. The small company, which had an operating capital of twenty-five or thirty thousand dollars, or even a hundred thousand dollars, had no possible chance of success on account of the fact that the questions arising from service, returns, and so forth, would swamp them financially.

Now, the Court being informed as to the practical situation in respect to what really did keep the industry back, that is to say, not a lack of knowledge, but a lack of practical experience and a lack of development of apparatus, not involving invention, I will attempt to confine myself to the practical issues in suit.

Q. 7 Well now, you failed to mention the condenser of either air or water cooling among any of the practical difficulties you have enumerated. Was that intentional?

A. I believe I said that the matter of cooling, both air and water, was well known and thoroughly understood for many years prior to the development of the household machine industry. It was known.

Q. 8. Was it known to you, say, personally, as early as—when was it, 1905, that you entered the industry?

A. Well, 1907, yes. It was known to me immediately at that time because it was a perfectly obvious thing to know.

Q 9 Well, I wish you would elaborate a little on that reply, as to what generally was known by you. For instance, the function and proportions or construction and things of that kind, if they were known, or how would you go about doing, or how did you go about doing to learn such information as was necessary for building condensers?

A. The function of the condenser in this refrigeration system has been gone over so thoroughly that I hate to say anything more about it, but it is an extremely simple thing, it is something which cools the refrigeratant, and that is the only function that the condenser performs, unless you make it large enough to act as a receiver. It performs exactly the same function as an automobile radiator, it is a coil of tube or a pot or tank into which you put something that you want to cool. Now, naturally, if you are going to cool it, you have got to put something on there to cool it with, and you apply either water or air to the surface of the condenser.

Now, if you have cold water—and as a general thing the cooler the medium the better the device will perform, within certain limits—if you have got plenty of cold water and it costs you nothing, you can use water. If water is not available, you can use air. Now, if you have got to use air and it is still air, you will get one result, or if you turn a fan on, you will get another result, exactly the same as if you are in this room in the summer time, and you are warm, you will get cool if you turn the fan on.

It takes no deep engineering knowledge or training to know that essential fact and that is the only essential fact that anybody had to know in respect to air cooling and the use of fans in connection therewith.

Changes necessary to transform machine from water to air-cooled type.

Now, if you want to make an air cooled condenser, having before you a water cooled condenser, you will proceed to add additional radiating surface in contact with the gas. If you have water cooled condenser containing, we will say, 30 feet of pipe, and you wish to air cool it, you simply add more pipe, and you can very easily and very simply arrive at a proper solution of the problem without any mysterious calculations at all, or any loss of time, by adding as much pipe as your pocket book will stand to get the result that you need in the finished machine; and the design of an air cooled condenser simply consists in doing that one thing: giving the most radiating surface for the least possible money; and there are many hundreds of different kinds of condensers, with and without fins and of all kinds and shapes and sizes and descriptions, gotten up for that reason, the commercial, practical reason, of their cost.

Now, as to the tubing, of which a great deal has been said in this suit, and to which some of the claims in suit are specifically limited, this 3-8 inch copper tubing of considerable length with the thin wall, there is no time since 1908 that I have been in any refrigeration plant, that is to say, manufacturing company or experimental laboratory, where I have not seen that tubing in common use. It is as common in the industry as wire nails are in a hardware store; it is a common article of commerce, and always has been ever since I can remember.

The very fact that these machines are small and compact necessitates the use of a small pipe to connect them up, because the pipes and the fittings and everything else around the machine must naturally be comparative in size with the machine itself, and any ordinary mechanic, any ordinary mechanic's helper of average intelligence, if he was given various parts of an ice machine to connect up, will use the most easily available pipe that he could get, which is the copper tube of 3-8 inch or thereabouts, and which he can buy anywhere, and for which he can get standard fittings.

Does that answer your question in respect to the air cooled condenser?

Q. 10 Suppose you had a condenser of, say, ½ inch tubing and you wanted to use 3-8 inch copper tubing, what would be necessary for you, as an engineer, to do in designing a condenser?

A. Calculate the area of the tubes and use sufficiently more of the 3-8 tubing to make up the difference. That I would have to get from some one of the numerous tables which have been published and which are known to all engineers, and in common use.

Q. 11 Do you know, as an engineer, that such tables were published prior to 1913?

A. Yes.

Q. 12 Have you personally used copper tubing of 3-8 inch diameter prior to 1913?

A. Yes.

Q. 13 In the refrigeration industry?

A. Yes.

Q. 14 And for condensers?

A. Yes.

Mr. Cooper: Well now, wait a minute. Is this gentleman set up as a prior user in your answer?

Mr. Frye: We are talking of his personal work?

Mr. Cooper: No, I am asking: Is this gentleman set up in your answer as a prior user?

Mr. Frye: No.

Mr. Cooper: Well, then, I object to interrogating him about prior use. The statute requires that you give us notice of that thing in your answer by 30 days' notice.

Mr. Frye: Your Honor we have pleaded in the answer that this was a common and well known device, and we are trying to prove it by the various witnesses by asking them if they have had personal use, or if not, if they know of use by others. We are not pleading any particular prior use. It is a rather general prior use, if the word can be used.

Mr. Cooper: Will you read the part of the answer in which your present statement is made, because I know of no such thing—one must have, one must, under the statute, before he can prove a prior use, set it up in the way the statute says.

The Court: He is showing the state of the art, is all.

Mr. Frye: I am asking for the personal knowledge of this particular witness.

Mr. Cooper: No, your question was for his personal prior use. I say that has not been pleaded, nor have we had notice of it under the statute.

The Court: I will take the testimony, but I think Mr. Cooper is right about it. If you are claiming a prior use, it should have been pleaded. I think it is admissible on the state of the art.

Mr. Frye: Your Honor, the only purpose of the question is to show familiarity of the witness with the particular size of tubing. He has already stated that he is familiar with copper tubing generally and has been for many years.

The Court: You may take his answer.

Mr. Cooper: It is under my objection, if your Honor please.

The Court: Yes, you may have an objection along that line.

Mr. Cooper: And I think, since it is an admission of evidence, I should have an exception, therefore, under the ruling.

The Court: Yes, you may have an exception.

Mr. Frye: I don't know whether it is in the stipulation or not, but it is quite usual that we will automatically permit exceptions to any ruling, and if it is not in the stipulation, we will be glad to agree to it.

Mr. Cooper: I suppose that exceptions are only given when counsel asks for exceptions.

The Court: Read the question.

(Record read by the reporter.)

Q. 15 Do you know that others, either in your presence or under your supervision, used copper tubing of 3-8 inch in the refrigerating industry?

Mr. Cooper: Well, now, we are going up a blind alley now. I don't know whether these other gentlemen of whom the witness is now being interrogated are those set up in the answer or not but I will object on the same ground. I don't see why we should be, after three years' duration in which there have been three set up also, and goodness knows how many pleadings, and in which the trial has been set three times, and every time adjourned at the defendant's behest, once on account of the sickness of counsel and another time because he backed out—why at this time, when we are half way through the trial, we should have new defenses pumped upon us. It seems to me that simply as a matter of fair play the thing should be kept within bounds.

The Court: The objection is overruled. I will take the answer. Read the question.

(Last question, No. 15, read by the reporter.)

A. Yes.

Q. 16 Are you familiar with the condensers used with ammonia as a refrigerant?

A. I am generally familiar with them.

Q. 17 Do you know of your own knowledge whether condensers were used with ammonia refrigerating machines that were air cooled during at least a portion of the year?

A. Yes.

Witness cites examples of ice plants which were air cooled in winter.

Q. 18 Will you state specifically where such machines were located and where used prior to 1913, if you know?

A. At the ice plant at Sumter, S. C., where they had an ordinary ice plant using ammonia and manufacturing ice, and in the winter time, when it was cold enough and they wanted to save water, they would shut the water off to condense; and I observed the same condition personally in a plant in Wilmington, Delaware, about, I should say, 1909 or 1910, operating under the same conditions.

Q. 19 Well, in the plant in South Carolina, did they shut off the water each winter that you had knowledge of it?

A. Well, I cannot say how often it was done. I expect it was done whenever they had cold enough weather to permit them to do it. Their plant was a very short distance across the railroad tracks from ours, and I spent considerable time there in work of one sort and another, and it was quite the usual and customary thing, and as a matter of fact, has always been quite the usual and customary thing, where water was expensive, or where they had the proper temperatures, to cut it down, particularly in freezing weather, where they do not want to get the cooling tower full of ice.

Q. 20 Now, are you familiar with the Wolf patent in suit, number 1377175?

A. I have considered this patent.

Q. 21 Well, have you studied same and do you understand the same, particularly with relation to claims 10, 15, 16 and 18?

A. I have.

Q. 22 The question is, do you understand it, also?

A. Yes.

Q. 23 And have you studied and are you familiar with the construction of the defendant's machine, which I believe is plaintiff's exhibit 7 in this suit?

A. Yes.

Q. 24 That is another double barreled question: I asked you, do you understand it also?

A. Yes.

Q. 25 Now, you have listened to the explanation of the patent suit, number 13377175, and without asking you to repeat in detail its structure and so forth, I would ask if there is any note that you would like to make on the record to differ with the statement concerning the disclosure of the patent by the plaintiff's expert?

A. You mean, in respect to the infringement?

Q. 26 No, in respect to the disclosure of the patent. Well, if you do not understand, we will ask the question in this way: Please tell us what is the subject matter of the Wolf patent, particularly in relation to the claims mentioned?

Mr. Cooper: Is that necessary, if your Honor please, unless the witness says he disagrees?

Mr. Frye: I am trying to stop it, exactly. He does not seem to get the idea.

Mr. Cooper: Well, you asked him, does he disagree with Mr. Sessions. Unless he does, it seems to me that explanation could stand for everybody. I do not want to interrupt the testimony.

Mr. Frye: I asked it that way first, and the witness did not seem to understand it.

Mr. Cooper: Well, let's see if he understands it.

Mr. Frye: I thought we would save more time this way.

Mr. Cooper: Let me put it to you as man to man: Is there anything about Mr. Sessions—

Mr. Frye: I don't know of anything personally. It all depends on what the witness has to say.

Mr. Cooper: Cannot you ask him the direct question, do you differ with Mr. Sessions' description or explanation of the Wolf patent in suit?

The Witness: His description of the Wolf patent?

Mr. Cooper: Yes.

The Witness: Not the claim, his description of the Wolf patent.

Mr. Cooper: That was all that we required.

The Witness: Yes, I agree with Mr. Sessions.

Q. 27 Now, I call your attention to the statement in the specifications, concerning the condensing coil, beginning on line 96 of page 1, and ask you if, in your experience as a patent attorney, you believe this is an unusual statement, in that it specifies sizes and dimensions.

Mr. Cooper: Is that material, if your Honor please, whether that is a usual or an unusual thing in a patent?

The Court: Well, he can answer it.

A. The inventor here states what he has found to give the best results. It is merely illustrative and informative, it forms no part of the invention.

Mr. Cooper: I move to strike out that last sentence, if your Honor please: it is a statement of a conclusion of law, I think.

The Court: I will let it stand.

Q. 28 The question was, whether that statement of dimensions was in your opinion an unusual one, or was it a customary one in patents?

A. Not in this art. It is an unusual thing in this art, because it is the repetition of a perfectly obvious thing, long known and described and used prior to this specification.

Q. 29 About how many patents on refrigeration do you think you have studied and analyzed in your experience, roughly?

Witness has made extensive study of patents.

A. Oh, something over 2,000, I would say.

Q. 30 And can you recall any other instance where they specified dimensions of pipes or other parts?

A. No, I cannot.

Mr. Frye: Your Honor, I am about to begin the comparison of the claims in this; if you will take a little recess, about five minutes.

The Court: Yes. We will take a five-minute recess.

(Recess.)

Q. 31 Now, in connection with your study of the claims of the patent in suit, here in issue, did you have occasion to study the file wrapper of the Wolf patent?

A. I did.

Mr. Frye: I would like to have marked the certified copy of the file wrapper, contents and drawing, the patent to Fred W. Wolf, No. 1337175.

Mr. Cooper: Are you offering it in evidence?

Mr. Frye: No, we are having it marked now for identification.

The Court: Number 25.

Mr. Frye: Number 25; to which has been attached copies of the various prior art patents referred to in the file wrapper.

Suppose we mark the copies of file wrappers of the patents 27, your Honor, because they are not part of the certified copies.

Q. 32 Now, with this file wrapper before you, I wish you would explain to his Honor, if you can, what is understood by you in claim 10, the first of the claims herein treated.

Mr. Cooper: Well, on that there was no examination in chief of plaintiff's witness. The defendant took up his understanding, Mr. Sessions' understanding, on cross examination, over my objection. I had not interrogated Mr. Sessions as to his understanding, and it does not seem to me that under the rules of evidence, counsel having elicited the understanding by an irregular cross examination of that sort, he can offer evidence to contradict it.

The Court: I think this is your affirmative case?

Mr. Frye: This is our main case; it is not rebuttal at all.

Mr. Cooper: No, I understand, but my point was that he went beyond his privileges as a cross examiner in taking up a matter of that sort with my witness, and I raised the point at that time that he was making my witness his own for that purpose, and my point now is, that under the ordinary rules of procedure or evidence he cannot, after having cross examined collaterally, introduce evidence to contradict that which he got on a collateral cross examination.

The Court: Overruled.

Mr. Cooper: I will take an exception.

Discussion of Claim 10 in Wolf Patent No. 1337175.

A. Claim 10 is a combination claim, and the first element thereof is "Means to compress a refrigerating gas"—that I take to be the ordinary compressor. I had great difficulty in understanding the words "To a pressure the corresponding boiling point of which is above the temperature of the atmosphere," and went to the file wrapper of the patent to find out just what that language meant. I will refer to that later.

"An atmospherically cooled condenser for condensing the compressed gas," is understood, means the usual ordinary condenser; an expansion chamber into which the liquid is expanded.

Well, Wolf's disclosure shows a coil, but the chamber or tank would be the same as a coil, and I understand that.

"Said parts being connected to form a closed circuit for the refrigerant."

Well, of course, they would not operate in any other way.

Now, turning to the file wrapper, to aid in interpreting the pressure, "The corresponding boiling point of which is above the temperature of the atmosphere," your Honor will observe that heat only flows from a higher to a lower temperature, therefore, the temperature of the refrigerant vapor must be raised above the temperature of the medium employed to carry the heat from the vapor refrigerant within the condenser, whether this medium be water, air, or any other substance. With all known refrigerants, other conditions being equal, the efficiency of power economy will increase as the temperature of the condenser cooling medium is reduced. It is true that in most localities the water available in summer is at a lower temperature than the air temperature, although there are exceptions to this, as, for instance, water cannot be cooled below 32 degrees without becoming ice, while atmospheric air frequently drops to many degrees below zero over large sections of the United States.

Now, the file wrapper states at great length that applicant's invention resides in a peculiar combination of sulphur dioxide, the refrigerant used, and an air cooled condenser, because the temperature of the sulphur dioxide at the pressure in the condenser is higher than air temperature.

Critical temperature of gases used as refrigerants.

Now this is misleading and almost directly contrary to the facts. It is badly expressed and I think the trouble is in the language rather than the intent the applicant's attorney had in prosecuting the application. There is only one refrigerant in general use that will not condense at a temperature far above that of the atmospheric air, and that is carbon dioxide, which must be reduced to about 87 degrees Fahrenheit in order to liquefy. I mean by that, your Honor, that you can squeeze that particular gas to almost any pressure without making it liquefy unless you reduce the temperature to about 87 degrees and that is the only refrigerant that I know of to which that rule does not apply; at least, it is the only refrigerant in common use in these household machines which they are talking about. They speak of the critical or highest temperature at which the better known refrigerants may condense by subjecting them to pressure, and these are as follows: Ammonia 270 degrees, sulphur dioxide 315 degrees, methyl chloride 289.8 degrees, and ethyl chloride 365 degrees, and carbon dioxide 87.9 degrees; these all being given in Fahrenheit.

The Court: At which? What?

The Witness: That is the critical pressure, the critical or highest temperature to which the refrigerants may condense.

Now if you heat them over that point, they will not condense, but will remain in a gaseous state.

The Court: You mean if you take—these are all condensed into liquid?

The Witness: At that point, but above that point they will not condense into liquid.

Mr. Cooper: No matter what the pressure?

The Witness: No.

The Court: But the pressures at which they can be—this variant—

The Witness: These are the pressures at which they will condense, but above these pressures—

The Court: At what temperature?

The Witness: Well, these are the temperatures. These are the temperatures here.

Q. 33 You said these are the pressures. Didn't you mean these are the temperatures?

The Witness: Did I say pressure? I meant to say temperatures in all cases.

The Court: What I was saying is the temperature at which ammonia will be compressed to that temperature is different than what sulphur dioxide would be compressed at 315.

The Witness: That is right.

The Court: But this, as I understand it, is the highest temperatures which this will take as a liquid under pressure, is that right?

The Witness: Yes.

Q. 34 Let us express it this way: Will or will not the various refrigerants that you have quoted, compress into a liquid at any temperature below those noted by you?

A. Yes, that will follow.

Q. 35 And the variations in pressure will bring them to the various degrees below these temperatures?

A. Yes, sir.

Q. 36 But above those temperatures they will not compress into liquid?

A. Yes, sir.

Mr. Frye: Does that help your Honor?

The Court: These pressures, again, from the different liquids, are not uniform at all?

Mr. Frye: I don't mean to say that, your Honor.

The Witness: I was bringing out this point of critical temperatures in order to attempt to find out what Wolf meant by his claim 10; the language being very difficult to understand. Now if he is talking about a critical or the highest temperatures at which these refrigerants may condense, then you will observe that all of this, all of these with the exception of carbon dioxide have critical condensing temperatures far above atmospheric air. We do not know of any air that is 315 degrees in the case of sulphur dioxide, so we could not find the answer to there. It must mean something else, so we go on to find out now what he did mean.

For the purpose of showing the relative power efficiency between SO2 and the other refrigerants, when their condensing temperatures are raised to a point suitable for air cooling, I have calculated a table here at 5 degrees evaporated temperature of the condenser temperature, and 86 degrees and 104 degrees respectively. We have got to, in the understanding of claim 10, put some temperature figure in there. It is not intelligible when he says that the boiling point is above the temperature of the atmosphere. What is the tempera-

Analysis of Claim 10 in Wolf Patent by Defendant's Witness

ture of the atmosphere? We have got to start either with a definite boiling point or definite atmospheric pressure. You have got to assume something definite in that claim in order to practically understand it. What is the temperature of the atmosphere?

The Court: Well, if you leave off the word "corresponding," isn't it understandable then, or is it still troublesome?

The Witness: It is just as troublesome then to me, because the corresponding boiling point which is above the temperature of the atmosphere, what does it correspond to, the temperature of the atmosphere? Then your Honor will observe there is nothing in the combination, for the following reason: I have assumed two temperatures, one 86 degrees and the other 104. The other assumption in this calculation, the evaporated temperature of 5 degrees, that is, the temperature at which the gas leaves the cold side, or evaporator and goes over to the compressor, that is universally adopted by the refrigeration industry as a kind of a standard, just as they assume that 86 degrees is the temperature of the liquid entering the expansion valve, these two figures are recognized by all authorities, and adopted universally by the industry. Now if you take these figures and air temperatures of 86 degrees and 104 degrees we have the following per cent increase in power required when the condensing pressure is raised from 86 to 104 degrees. For ammonia that figure is 27.8, and I am speaking now of the percentages, and for sulphur dioxide 28.1 and for methyl chloride 27.5, and for ethyl chloride 26.85, and it will thus be seen that instead of sulphur dioxide having advantage over ammonia due to a co-operation between an air cooled condenser and a material like sulphur dioxide as a refrigerant, that all the other refrigerants listed have a slight advantage over sulphur dioxide when operated at temperatures suited to air cooling.

Now turning to the file wrapper of the Wolf patent, on page 49 thereof—

The Court: If it said "Below" it would read all right, then, according to your theory?

The Witness: Well, your Honor, I have no theory in respect then to what that language means, I am taking the standard gas tables which are known to physicists and engineers the world over, and have been known for many many years prior to the filing date of Wolf, simply taking the data given in those tables and have tried to construct from it something that will interpret this claim. If it means anything I want to know what it means. Now if the efficiency of the Wolf device is dependent upon a particular co-operation as he says it is, between sulphur dioxide and the air cooled condenser, then it should be evident from the study of the gas tables, but it is not.

Now on page 49 of the file wrapper, in the amendment filed in the patent office August 24, 1918, applicant's attorney said: "It should further be noted that the applicant is not broadly claiming an air cooled condenser. On the contrary the claims are directed to a combination of sulphur dioxide as the refrigerating agent, and the air cooled condenser."

I fail to find anything in claim 10 that limits him to a specific form of condenser. I fail to find anything in claim 10 that limits him to any particular refrigerant.

Then they filed a disclaimer, they filed a disclaimer and read into the claim that the condenser should be comprised of a considerable length, whatever that means, of copper tubing, not over 3-8 of an inch in diameter, having a substantially thin wall.

The Court: You take it he had in mind that the combination of an air cooled—putting emphasis on the "air cooled"—air cooled condenser with sulphur dioxide was in combination?

The Witness: Yes, your Honor, that is what he says.

Mr. Cooper: Will your Honor look at the preceding page of that same action by the patent office, and you will see near the top beginning a discussion of new claims 9 and 14, calling for an apparatus employing sulphur dioxide and an atmospherically cooled condenser, and that continues down to this point where he says: "On the contrary claims," and I think he is referring simply to those particular claims that were there involved, I don't think he meant generally, because he said on the contrary, claims.

Testimony of Defendant's expert checked with that of Plaintiff's expert.

The Court: I hate to interrupt this witness, but I don't remember now just how Mr. Sessions explained that to me and what he said that meant.

Mr. Cooper: Without having it go in the record, cannot Mr. Sessions state it informally to your Honor?

The Court: Yes, and you can put it in the record, and can strike it out easily enough.

Mr. Sessions: The boiling point of the liquid and the liquefying point of the gas which is evolved at that boiling point is at the same temperature. Mr. Hayes explained that this morning, that the boiling point and the liquefying point, that is the boiling point of a liquid turning into gas while the liquefying point of a gas turning into liquid are the same at any pressure.

The Court: At the same pressure.

Mr. Sessions: Yes, at the same pressure. Now this claim states that the compression should be such as to be able to compress the gas to a pressure, the boiling point of which—

The Court: Namely, the point where it turns from gas to liquid and liquid to gas.

Mr. Sessions: Yes. Is above the temperature of the atmosphere.

The Court: Well, that is not true, is it?

Mr. Sessions: If it has a 70 degree atmosphere the boiling point must be about 70 degrees.

The Court: Well, that is not where your gas comes in here at about—it boils at—that sulphur dioxide you use will boil at 6 degrees, won't it?

Mr. Sessions: Under certain pressures, or a vacuum, but this relates to the compression side, the side where the compressor is compressing the gas to the highest high temperature, so we will be able to extract the heat, it must be such a pressure that the temperature of the boiling point or liquefying point of the gas is above that of the surrounding air so that heat may be transferred from the liquid in the pipe to the air outside.

The Court: I don't see what that has to do with the boiling point right now. You have to compress it so the temperature is above the temperature of the air?

Mr. Sessions: Yes, sir.

The Court: But you compress it—it seems as though if you compress it until the temperature is above the temperature of the air, but the boiling point—

Mr. Sessions: The boiling point of any pressure that might be arrived at is the temperature of the boiling point—that is, the temperature of the boiling point cannot be above the temperature of the surrounding air. Suppose, for instance, we compress it only to 50 pounds pressure, it is possible that the boiling point at 50 pounds pressure would not be above the room temperature of 70, and we would get no exchange of heat from that gas, and it would never be converted into liquid.

The Court: Well, now I guess I can better understand the witness. You say that the boiling point of this is 35?

The Witness: I said the critical temperature above which it would not condense was that. I put that in there in an effort to show your Honor that I had considered all possible phases of the matter in order to arrive at an understanding of what Wolf invented so I could read the claim on that, and then I turned to the file wrapper to find out what he invented, and I found out that he says here he is not broadly claiming this air cooled condenser, he is claiming it in combination with sulphur dioxide as a refrigerant. Now the defendant here does not use sulphur dioxide.

The Court: Does not claim 10 mean that he compressed that until, under that pressure, sulphur dioxide would not boil except at a point above the temperature of the air?

The Witness: Yes, your Honor, that is a universal law that applies to all gases, but his claim is not restricted to that. There has got to be some differentiation in the claim as between what he invented and what he did not invent.

The Court: In the first combination he says means to compress, and then says how much he is going to compress it, and isn't he right in the amount he does compress as he says there, I mean the plaintiff—

The Witness: Yes, that is right, we are in thorough agreement with that. It is the law of gases, you cannot do otherwise.

The Court: What is there in 10 that you say you don't understand?

The Witness: I was endeavoring to find out what he meant by compressing the gas to a pressure the corresponding boiling point of which is above the temperature of the atmosphere.

The Court: He compresses it until it will not boil at atmospheric temperature.

The Witness: We understand that with respect to sulphur dioxide, and we understand it after studying this claim, but it it not limited to sulphur dioxide, it applies equally well to half a dozen other gases.

The Court: The same thing would apply to others?

The Witness: Yes, and if it does differ it is not invention. Of course ordinarily—I will discuss later on that that is a common attribute to all gases.

The Court: I didn't think I was getting the most of what you were trying to say to me, and I would like to interrupt to get it soaked in.

Q. 37 Is there such a thing as the boiling point of a gas? Or do we understand in claim 10 the boiling point of a liquid?

Yes, I think I do.

Mr. Cooper: Now, which branch of the question is the witness answering? You asked him one and he hesitated, and then you asked him another.

Q. 38 Will you explain the point to his Honor?

A. Well, I take the boiling point of the gas or the point at which the gas will change from a liquid to a solid, or from a solid to a liquid, under the pressure conditions then existing in the condenser.

Mr. Cooper: From a solid to a liquid?

The Witness: From a liquid to a gas, I mean.

The Court: And we have to know the pressure in order to state what the boiling point is for any substance?

The Witness: Yes, sir.

Q. 39 Now, if you use that understanding for the boiling point of a gas, then the next clause, the corresponding boiling point of which is above the temperature of the atmosphere, have you not said that that applies—didn't you say that that means that that applies equally well or better to ammonia than to sulphur dioxide?

A. Yes, it is common to all gases.

Q. 40 So that there is no special advantage such as is set up in the file wrapper that you read?

A. None whatever.

The Court: And that is a thing that would have been true under all the previous refrigerating systems?

The Witness: Yes, your Honor, that element is old.

Mr. Frye: He said all except CO_2 or carbon dioxide, or something of that kind.

Discussion of Claims 9 and 14 in Wolf Patent.

Q. 41 Now I want to call your attention to the preceding page from the one you read in the file wrapper where he states concerning new claims 9 and 14. Will you note what is said there?

A. That is page 48 of the file wrapper, the same amendment as previously mentioned:

"New claims 9 and 14 call for an apparatus employing sulphur dioxide as the refrigerant in an atmospherically cooled compressor. It is thought that this is a new and novel combination. As the Examiner is well aware, inventors have sought for a long time to do away with the water required to cool condensers in order to save expense and also bother, particularly in household outfits of the present type. No one prior to the applicant succeeded, hence in view of the long search by skilled inventors, it seems evident that applicant's step forward in the art was not obvious. Further there is a proper combination between the use of sulphur dioxide and air cooling, as will now be explained. Heretofore ammonia has been employed almost universally as the refrigerating agent, whereas the use of sulphur dioxide has been practically nil. The boiling point or condensing temperature of ammonia at the pressures usually employed in the condenser is below the usual temperature of the atmosphere."

The Court: Is that true?

The Witness: No, not necessarily.

The Court: All right.

The Witness: "Hence the air cooled condenser could not be efficiently used with ammonia; on the other hand the boiling point or condensing temperature of sulphur dioxide at the pressures in the condenser is above the temperature of the atmosphere, and consequently sulphur dioxide can be condensed in an air cooled condenser."

What he failed to state, your Honor, was that the conditions in respect to sulphur dioxide were exactly the same as in respect to ammonia. In his discussion in connection with ammonia he says: "It cannot efficiently be used with ammonia." But he fails either intentionally or unintentionally to go on and state that even if the sulphur dioxide is used it still cannot be efficiently condensed as compared with water condensation, a point which no engineer in this Court can deny.

Now he goes on to say in the file wrapper: "This is applicant's discovery and invention." What? "That it was obvious is negatived by the fact that it was not discovered by any of the many skilled inventors seeking the same goal."

An examination of the file wrapper shows that what Wolf went into the patent office and attempted to claim and did finally get, was a patent on the combination of sulphur dioxide and an air cooling condenser, subject, of course, to the disclaimer filed since this suit began. It alleged a specific combination, which there is not and cannot be at any time.

The Court: In the use of ammonia they must have had the pressure such that the boiling point of ammonia at that pressure was above atmospheric temperature.

The Witness: Yes, your Honor, always. The situation in respect to condensing ammonia is identical with that to condensing sulphur dioxide, except it takes place at a higher temperature in the majority of cases.

Q. 42 Those quotations that you have just made from the file wrapper relate to claims 9 and 14 particularly, do they not?

A. Yes.

The Court: If I understand you it would be like saying I want to get a patent on this watch of mine, because it is Eastern Standard time, while these clocks around Bay City are an hour too slow. They could be changed as easy as the watch if that was the only reason.

The Witness: Yes.

The Court: There might be still something different and entitled to a patent on the watch over the clock, but that thing was without value.

The Witness: Yes, your Honor—

The Court: In other words, as I understand here he is claiming an advantage for sulphur dioxide over ammonia, which you say that particular advantage that he states did not exist at all.

The Witness: It cannot exist and it does not exist.

The Court: So that sulphur dioxide may have advantages over ammonia or other things, but not that.

The Witness: Not that particular advantage, and then the claim was extended to include the other refrigerants, and if this Wolf patent claim is valid and the combination of sulphur dioxide with the compressor and an air cooled condenser, then A. B. and C. could go out and patent a series of machines, each one containing some different refrigerant, each one operating at identically the same cycle, and with identically the same component parts, but having some different refrigerant. There is no element in this claim, as we will propose to show, which was new with Wolf. The claims originally filed in the Wolf application were directed entirely to the shape of his condenser.

He coiled it around his machine in loops, and I think he was undoubtedly entitled to a patent, he invented a specific form of use. Air cooled condensers have been known and in common use long before Wolf came into the art, and I think he was entitled to a patent, but he has no new element in this combination here that we can find.

The Court: This number 10 is a disclaimer.

Mr. Frye: That is the one he has been talking about, your Honor.

The Court: I take it by their disclaimer they come pretty near to admitting that there would not be anything new in it, and that is the reason they are disclaiming, I assume.

Q. 43. Will you state how that refers the new claim 10 to claim 9 about which the argument you have quoted was made?

A. A condenser made out of a piece of ⅜ inch copper pipe, at the bottom of this same amendment from which I am reading in the file wrapper, he states the following in respect to claim 10 of the patent in suit: "New claim 10 is similar to claim 9 except that it defines the refrigerating gas as one which is compressed to a pressure, the corresponding boiling point of which is above the temperature of the atmosphere." That is our old friend again, and it applies to any and all refrigerants with the possible exception of CO_2.

The Court: He does mean by that language, doesn't he, that he has a contraption for compressing by which he makes pressure so great on this refrigerant that the boiling point of it is above the temperature of the surrounding air?

The Witness: Yes, your Honor, that is it exactly, and that applied to every one of the refrigerating machines of the prior art of the compressor type, of which there were hundreds.

Q. 44. Now further on in the file wrapper I would ask you to state whether or not claim 10, along with the other claims in issue here were finally rejected by the Examiners?

Mr. Cooper: Why examine about that? It appears on the face of the record.

Q. 45. Now will you state whether it was on 10—

Mr. Cooper: Why bother with that, that appears on the face of the record. We can all read that.

Q. 46. Did you say yes?

A. Yes.

Q. 47. Now will you note the argument made by the applicant, or the attorney for the applicant on appeal, and see if you find equivalent statements to what you have just quoted as made before the Examiner in his attempt to secure the allowance of the claims here in issue.

Mr. Cooper: That of course calls for a conclusion, your Honor. Isn't it sufficient for counsel to base an argument on these documents? That is all it seems to me this art of an examination comes to, a restatement of an argument; the documents are all in court and counsel has indicated he is going to offer them in evidence, and he can make his argument on them. I don't see why the trial should be delayed for a matter of this kind that is a matter of argument.

The Court: Overruled. I have got to read these anyway and I might as well have them read to me while their expert is here to discuss it.

The Witness: On February 4, 1920, Wolf's attorneys filed in the patent office a brief.

The Court: How can I tell where I am in the file wrapper?

The Witness: On the file wrapper, page 63.

Mr. Frye: That is marked in pencil or something below, your Honor, "63."

Witness says water controls were available.

A. (Continuing) The first sets forth the object of the apparatus, and states that one of the principal defects has been the requirement of water to cool the condenser. "Not only has it been necessary to go to the trouble of connecting up the condenser with a supply of water, but in the operation of the plant someone must give attention to control the supply of the water. Thus, even if the motor for driving the compressor has been controlled automatically by the temperature in the refrigerator, the plant has not been entirely automatic because of no automatic control for the water."

Right there, your Honor, I want to observe that automatic water controls were well known and in common use long prior to this statement. There are several patents on them, which I will introduce at a later time; so that that statement was entirely erroneous and misleading.

Then the attorney goes on to say, that, "according to the present invention, this defect and the trouble and bother resulting therefrom has been eliminated by providing an air cooled condenser. Moreover, applicant employs sulphur dioxide as the refrigerant, and this is an important feature, because there is a co-operation between an air cooled condenser and a material like sulphur dioxide as refrigerant."

Now, he repeats there at considerable length the same set of reasons that we have just gone over at great length, and I will not take up the Court's time on elaborating on that point. He is still insisting that an important feature is the co-operation between this specific refrigerant—

The Court: Let's take that next sentence, though.

A. (Continuing) "When ammonia is employed as the refrigerating agent, its boiling point at the pressures in the condenser is below the atmospheric temperature."

The Court: Now, that is not necessarily so.

The Witness: Not at all. The statement does not mean anything—(Resumes reading) "Hence an air cooled condenser could not be employed efficiently if ammonia were the refrigerating agent. As compared to ammonia, sulphur dioxide at the pressure in the condenser has a boiling point above the atmospheric temperature. Hence with an air cooled condenser, as the air is at a lower temperature than the liquefying point of the compressed sulphur dioxide, it may be condensed efficiently."

Now, that whole thing is a misstatement of facts from beginning to end. There is no more efficiency present with the sulphur dioxide than there is with any one of a number of other refrigerants.

The Court: So far as the reason he uses?

The Witness: Exactly. Sulphur dioxide is used in those small machines for an entirely different set of reasons, which need not be brought into this suit; but the specific reason on which Wolf was granted the patent by the Appeal Board does not exist at all.

Q. 48. Now, is any mention made as to the claims he refers to by the argument in his brief before the Board of Appeals?

A. Yes, these are the claims in suit.

Q. 49. Well, would they be collectively all of the rejected claims in your opinion, which include claims 10, 15, and so forth, in suit?

A. Yes.

Q. 50 Now, please turn to the decision by the Board of Examiners in Chief, and see if you find similar language used in the decision.

The Court: What page is that?

Mr. Frye: It begins on page 73, your Honor, as it is numbered at the bottom. It is probably—beginning with the last paragraph on 73, I would say, your Honor, unless he wants to go somewhere else.

A. On March 4, 1920, the Appeal Board rendered its decision. I will now quote from that decision, with a view to pointing out to your Honor the fact that these misleading and incorrect statements, which had been made to the primary examiner during the prosecution of the case, misled the Board, and on that, or under the misapprehension which existed in their minds, they granted the applicant the appealed claims.

I will now quote from the Board's decision.

"Applicant states that one of the principal defects in refrigerating devices"—

The Court: Well, it is "Appellant," not "applicant"; appellant.

The Witness: Appellant, yes.

Mr. Frye: It happens to mean the same here.

Mr. Cooper: I think it is only fair to have called to the Court's attention that at the beginning of their decision, they chose claim 9 as an example, as the only example, and that is a claim that included in combinations by statement, the sulphur dioxide gas.

Mr. Frye: Simultaneously, your Honor, I would like to call your attention to that in the brief before the Board, the attorney also called attention to claim 9 specifically, and the only one specific claim, the rest of the argument was made collectively, and the decision here, we believe, is made collectively.

Mr. Cooper: Well, you had your witness say just now that the brief was on all the claims, because all were quoted at the beginning. Now you want to say something else. Go ahead.

Mr. Frye: If you will look at the last of the brief—

Mr. Cooper: I am saying what you brought out by your witness as to that brief.

A. (Quoting): "Appellant states that one of the principal defects in the refrigerating devices of the general character herein involved has been the necessity of using water to cool the condenser. According to the present invention, the condenser is air cooled, which is rendered possible by the use of sulphur dioxide in the refrigerant."

Now, I want to call your Honor's attention at this point to the fact that the Board states that the use of sulphur dioxide makes air cooling possible. No such state of affairs existed. That is absurd. The study of a gas table will readily reveal the fact that you could condense any gas that is commonly used by means of an air condenser, if you make the surface big enough to cool it.

The Court: To a point where its boiling

(Continued on Page 40)

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point is above the air.

The Witness: Yes, your Honor. Now, "Appellant asserts that there is co-operation between the air cooled condenser and the particular refrigerant specified, since the ordinary refrigerants, such as ammonia, have boiling points at the pressures in the condenser below the atmospheric temperature."

The Court: Which is not true.

The Witness: It is not true, and it does not mean anything, but the Board evidently thought it did, "Hence the air cooled condenser could not be employed efficiently if ammonia or the like were the refrigerating agent."

The Court: That, however, would be just practically as much a bar to water cooled if they had been right about it, as it would to an air cooled?

The Witness: Exactly. "Sulphur dioxide, on the other hand, at the pressure in the condenser, has a boiling point above the atmospheric temperature, hence with an air cooled condenser, as the air is at a lower temperature than the liquefying point of the compressed sulphur dioxide, it may be condensed efficiently."

Mr. Sessions explains meaning of statements in the patent.

The Court: This is a poor way, I know, but I am trying to get at this. Let me ask Mr. Sessions: Aren't they entirely wrong in their reasoning there?

Mr. Sessions: On this matter of ammonia, the statement that Mr. Van Deventer has quoted from the file wrapper, I think what the counsel who wrote that statement had in mind was this: that at the pressures at which it is desired to operate these small compressors, pressures of gas, ammonia will not reach a temperature above the atmosphere of 90 pounds; for instance, at 90 pounds pressure, ammonia boils at 60 degrees and you would have to compress it above 90 pounds in order to get it above the temperature of the atmosphere.

This file wrapper states that ammonia, the temperatures of ammonia are below those of the atmosphere. Now, when you take it at a point like that, I have a curve here of the various gases, which show the boiling points at different pressures. For instance, here is ammonia at 90 pounds gauge pressure, boils at about 60 degrees. Now, if your atmosphere was only 60 degrees, it is obvious that you would have to compress above 90 pounds pressure in order to have an air cooled condenser.

Well, they have said it was below, the boiling point of ammonia was below the temperature of the atmosphere. That is true at certain pressures, and the curve for the boiling point of ammonia goes up very rapidly. When you get up to a temperature of 100 or 110, which is an atmosphere in which these small household refrigerators have to operate, you have pressures of ammonia running up to 250 pounds; you would have to compress the ammonia, so, in order to get a 20 degree drop for cooling, in the condenser, you would have to compress the ammonia up to 285 pounds pressure before its boiling point would be above the atmosphere of 110 degrees.

The Court: All right.

The Witness (Mr. Van Deventer): I will beg the indulgence of the Court to comment for just a moment on what Mr. Sessions has put in there.

The Court: I will be glad to have it; it will help me more than any other way.

The Witness: According to his interpretation of this fan here, we have a device here which infringes or does not infringe depending upon the state and condition of the weather and the temperature. If they can put that construction on what the attorney mean to say, and what the patentee meant to claim, is here, why, at some periods of weather, these machines would infringe, and at other times they would not.

Now, if that claim means anything at all, it means something which is good for all ranges of atmospheric temperature.

Mr. Cooper: In the household?

The Witness: Is there any limit to the atmospheric temperature in the household?

Mr. Cooper: There is in mine.

The Witness: Well, that is a particular, individual, personal matter.

Mr. Cooper: And all my neighbors.

The Witness: There are probably households that range all the way from zero to 120. We are dealing with something very specific, a patent claim which is supposed to map out the meets and bounds of the invention, and I have been trying to find out what it was that Wolf invented, and whether or not the language of the claim expressed that.

Now, what he has got into the claim is something which is an inherent thing in all refrigerants, which was nothing new, and which was well known to hundreds of men, thousands of them.

What the Plaintiff has failed to point out so far in the situation, in making their comparisons between ammonia and sulphur dioxide, is that ammonia is not used in household machines for a number of reasons, entirely separate and apart from that of cooling. If they could make compressors that would handle small quantities of ammonia efficiently, they would never use any other refrigerant, but they cannot.

Now, you can pick out any one of a number of other refrigerants. Here is methyl chloride, which is used by the defendant in this case, and ethyl chloride, which is another refrigerant, which condenses at even a lower pressure than methyl chloride; and yet, these claims will cover any of these refrigerants, with a common ordinary compressor known and used 20 or 30 years before Wolfe came into the field, with an ordinary air cooled condenser, which was quite old, and which anyhow we say was no invention, made out of 3/8 inch pipe, which is also a very old and well known thing to use for the purpose.

Q. 51. Summing up the file wrapper with regard to claim 10, would you give it as your opinion as a man experienced in patents, and also experienced in mechanical refrigeration, that that claim is sufficiently intelligible to tell you what not to do to avoid infringement.

Mr. Cooper: I think, if your honor, please, that is calling for a conclusion of law.

Mr. Frye: It is an opinion, exactly what I am asking him.

Mr. Cooper: No, no, no. I did not make that objection. If you want to quote me, I wish you would quote me correctly. I am making the objection that that is calling for a conclusion of law. If you want to quote me, quote that back.

Mr. Frye: I thought you were quoting me.

Mr. Cooper: I say the question calls for a conclusion of law, and is incompetent.

The Court: I will take his answer.

Mr. Cooper: I will take an exception.

A. As I understand this question, it is double barreled. First, you asked my opinion of the claim from the patent standpoint, and secondly, from the standpoint of a practical engineer.

Q. 52 No, I say, with your combined experience as both a patent man and a mechanical engineer, can you understand what not to do to avoid infringement of claim 10? If you do not understand the question, sav so, and we will put it a different way.

A. I do not understand the question. I could substitute some element here, such as a water cooled condenser—

Q. 53 No, the question is, can you, as a mechanical engineer, experienced in these things and accustomed to reading patents and patent claims, understand from the wording of claim 10, with the help of the file wrapper, so that you would know what not to do to avoid infringing claim 10?

Mr. Cooper: May I have a preliminary question on that before that interrogatory is answered? May I ask the question, does he understand claim 10?

The Witness: I think I do.

Mr. Cooper: All right: Will you state your understanding of it, and maybe that will involve the question that counsel is trying to ask.

The Court: He may answer if he can.

The Witness: I do not yet understand that question, Mr. Frye.

Mr. Frye: Well, we will withdraw it. Let's get on something else.

Q. 54 Now, referring to the remaining claims in issue, to wit, 15, 16 and 18, would you say that they are subject to the same objection, that is, that has been raised to claim 10 by virtue of the misstatements in the file wrapper and the apparent acquiescence of the board of Examiners in Chief, in such misstatements.

A. Yes.

Mr. Cooper: I wish the witness would look at the last full paragraph in the Board's opinion before he commits himself too far on claim 15.

The Court: Which page of the file wrapper?

Mr. Cooper: 75.

A. The record is a very long one, and I am carrying the fact in my mind that all these claims were allowed on appeal. (Witness refers to document.)

I do not see that that has anything to do with it, Mr. Cooper.

Mr. Cooper: All right, I called your attention to it. I am quite sure that it does.

Q. 55 Now, have you attempted to apply the claims here in issue to defendant's structure, as exemplified in exhibit 7?

A. I have.

Mr. Cooper: If your Honor please, that is under the same sort of an objection; that is, over my protest, the gentleman on the other side asked Mr. Sessions specific questions bearing on the application of the claim to the defendant's structure, and even went to the extent of seeming horrified because I stated that I had not opened up that subject—which I had not—and I raised the question of a collateral cross-examination and its effect on binding counsel, who indulged in that as to the answer. It seems to me that it is not open to him to call another witness to attempt to contradict the opinions that he elicited from my witness in that way.

The Court: Overruled.

Mr. Cooper: Take an exception.

Q. 56 Have you answered the question?

A. Yes.

Q. 57 Will you tell the Court as briefly as possible whether or not you find any differentiations in wording between the claims referred to, and the defendant's structure? In other words, if you can group them all, do so; if you cannot, why, refer to them individually.

A. It will be necessary to take them up one by one because there are differences in the claims, but I will attempt to be brief:

In claim 15, the various elements are recited, and the claim winds up by stating that there is "A fan mounted to effect a circulation of air around the condenser and against the compressor," and that is the fan made up in the fly wheel spokes of the Wolf compressor.

Cooling of Absopure compressor by the fan is incidental. Same compressor used in water-cooled units.

Now, in defendant's structure, exhibit 7, the fan is mounted upon the shaft of the electric motor, and it is removed as far from the compressor as the side of the refrigerator cabinet will permit. It does not effect a circulation of air against the compressor. Any circulation of air in respect to the compressor that takes place from that fan, positioned as it is, is entirely incidental, and performs practically no function.

The best evidence of that, your Honor, is that when the defendant makes up this unit, using exactly the same compressor in a water cooled system; that the compressor is not cooled in any way, shape or form, either with air or water. If any cooling takes place, it is incidental and of an immaterial degree. The air in there may be stirred up very slightly by the fan, but it isn't put there for that purpose. The defendant's fan is used solely for the purpose of effecting circulation of air around the condenser, and in respect to blowing against the compressor, defendant does not infringe claim 15.

Q. 58 How is defendant's fan mounted with relation to alignment with the compressor—I will say defendant's construction?

A. Well, the fan is in axial alignment with the compressor shaft.

Q. 59 It is in axial alignment with the motor in defendant's construction, is it not?

A. Yes, it is mounted upon the motor shaft—directly upon the motor shaft.

Q. 60 Is the compressor at right angles to such shaft, or in alignment with it, or at any angle to it?

A. No, it is in alignment with it, displaced from the motor.

Q. 61 At one side of the motor, is that what you mean?

A. The shafts are parallel to each other and separated by the distance of—if you wish it exactly, I will go to the exhibit and measure.

Q. 62 No, we merely wanted you to state on the record the location of the fan relative to the compressor. I think you have done so. If you would like to add anything—

A. I would like to state definitely the exact number of inches between the shaft.

The Court: I will leave the room while you are putting that on the record.

(Thereupon the Judge left the Court room.)

(The witness measures defendant's exhibit 7, and states on the record that he finds the distance between the motor and the compressor shafts to be 8½ inches between centers.)

(Thereupon the Judge returned to the Court room.)

Mr. Frye: Your Honor, we put in that distance as 8½ inches, and then we stopped.

Q. 63. Is there any further difference that you desire to call attention to?

A. In claim 15 an expansion chamber is recited, and this also applies to claims 16 and 18.

Q. 64. How about claim 10? Have you already disposed of that, is that your understanding?

A. The same words appear in claim 10. The Defendant's machine, exhibit number 7, has no expansion chamber unless the coil pipe forming the evaporator is considered to be the equivalent of the chamber.

The Court: It really is, isn't it?

The Witness: It really is the equivalent of the chamber. The two things, that is to say, pipes, coils of pipes, and tanks or chambers, vessels of various sorts, have for many years been interchangeably used in this art.

Mr. Cooper: Well, it is true in the patent, isn't it, that the expansion chamber shown there is a coiled pipe?

The Witness: He calls it in his specifications an expansion coil, line 51, page 2. In the claim, it appears as an expansion chamber. I wish to point out that technical difference, however, between Defendant's exhibit 7, and the claims of the patent in suit.

The Court: In 16, they leave out "Against the compressor," I notice, as to the fan.

The Witness: Yes, your Honor.

Q. 65. Have you finished your answer to that question?

A. Yes.

350 prior art patents set up in Defendant's answer.

Q. 66. Now, have you studied the prior art patents set up in Defendant's answer herein?

A. I have.

Q. 67. Do you find any of them that in your opinion anticipated the subject matter of the claims here in issue, whether individually or collectively?

A. I do.

Mr. Cooper: Are you going to go into all those set up in your answer I think there are something like 350,—or are you going to select out?

Mr. Frye: I am asking him if he found any, and am going to let him select them.

Mr. Cooper: Oh.

Q. 68. Will you take them one at a time and call to his Honor's attention, point out what elements in the prior art patents you consider to anticipate the elements, or what combinations, the combinations, without specific question and answer? Which one are you beginning with?

A. 63413, Lowe.

Mr. Frye: We ask that Mr. Van Deventer, the Lowe patent, if you will remember, was not cited in the answer. It was so admitted, if we are not asking for interpretation of prior art, but anticipatory patents, in this question. Lowe we used in the other one, if your Honor will remember, and it was not set up in the answer.

Q. 69. So, to keep in order the ones that we have previously used, let me ask you to begin with the Palmer, 706091. That is now marked as an exhibit, number, ——

Mr. Cooper: Then you have withdrawn 33413 from the witness' attention, have you?

Mr. Frye: No, he just recalled to my attention there was something already in the record, and I thought I would bring it up to date, referring to those now in before having him take up any new patents. That is exhibit 15, and I would like you to take that first if it won't upset you.

The Court: Is that in this book?

Mr. Frye: Yes.

The Court: What number?

Mr. Frye: Palmer, 706091.

Mr. Cooper: That, of course, was a patent that was very fully exploited by Mr. Sessions in his cross-examination. I called attention to the fact that it was quite beyond the scope of his direct, and counsel insisted upon examining him as his own witness, and it seems to me it is not open to him to examine another witness for the purpose of contradicting a collateral cross-examination, and that that matter is at rest. You have to accept Mr. Sessions' opinion, it seems to me.

The Court: Overruled.

Mr. Cooper: I will take an exception.

The Court: Now, I have got Palmer.

Comparison of elements in the Palmer and Wolf Patents.

The Witness: The Palmer patent, as your Honor knows from the former discussion of it, is a refrigerating system applied to a car, and the drawing figures 1 and 2, show the air cooled condenser (B) and the fan (C).

Mr. Frye: I desire at this time to have marked for identification enlarged chart bearing figures 1 and 2 of the Palmer patent now under discussion, and ask the witness if he can to point out the elements in A or B that he has been mentioning on such chart. I think it will help your Honor.

(Chart referred to marked "Exhibit 28" for identification.)

The Witness: This patent to Palmer also contains each and every element of the claims of the Lowe patent.

The Court: In connection with your discussion, as you take up these patents, I would be glad to have you point out to me where you find an element of the claim of the patent in suit, and if you do not find them, tell me which ones you do find and which ones you do not as you go along.

The Witness: I will direct your Honor's attention now to claim 10 of the Wolf patent, and will divide that into specific groups or elements, as:

First we have refrigerating apparatus:

(A) A refrigerating apparatus comprising in combination:

(B) Means to compress a refrigerating gas. That is the pump (P) of Palmer.

(C) To a pressure, the corresponding boiling point of which is above the temperature of the atmosphere.

That, your Honor, is the refrigerating gas in this device of Palmer's. He says that the refrigerating apparatus comprises a pump (P) which is used for compressing the refrigerating fluid and for forcing out

(Continued on Page 41)

PATENTS
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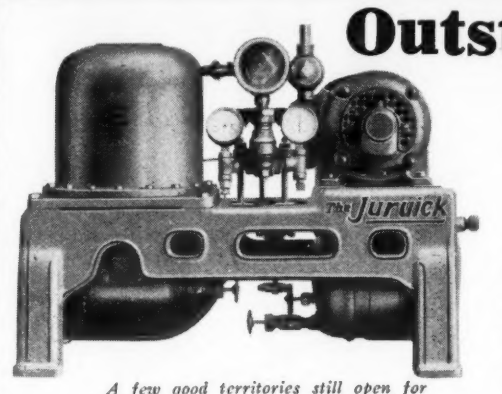

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through the pipes (B) in the condenser, and then for conducting it through the refrigerating pipes located within the chamber (L); also of the mechanism for driving said pump. The drawings of the Palmer patent show the usual closed circuit refrigerating system.

The Court: Does he say what kind of a refrigerant he uses?

The Witness: He does not.

The Court: But you say that in any event it would have to be put to a pressure such that the temperature, when so compressed, of the refrigerant would be higher than that of air?

The Witness: It would.

The Court: That is true of every—

The Witness: That is true of every refrigerating system of which I am aware, with one or two exceptions, which are not in commercial use.

At the time the Palmer patent was applied for, January 24, 1901, the closed circuit refrigerating system, meeting that element of the Wolf claim, was in common use and widely known.

(D) "An atmospherically cooled condenser for condensing the compressed gas."

That is the pipe small (b) and the way that is operated is this: There is an air duct (k) that passes down and communicates with the fan (C) which is driven on the shaft of this pump (P) here, the same as Wolf drives his fan, only this is not in the fly wheel, that is not the fly wheel spokes, this is shown as a separate thing.

Now, this duct in which this incoming air is insulated from the cold side of this car by ordinary wooden wall, and it is extremely improbable that any cooling effect on this incoming air takes place from this wall. It is not so intended. If there was any cooling effect, it would be so slight, that it would take a laboratory thermometer to measure it.

The Court: If they wanted to do that, they could run the pipe down through the thermometer part.

The Witness: Exactly. They did not want to do it, because that would be lifting yourself by your boot straps. You cannot cool this machine with any cold you make over here. If you could, you have got perpetual motion.

The Court: You are warming air.

The Witness: So this outside air here is taken into this cooling fan here, blown up this passageway here and out, and it is taken also by means of a side pipe in here, communicating with this chamber (2) and blown out into this whole compartment here.

The Court: For the dust purpose?

The Witness: For the purpose of forcing the dust out and keeping these belts and pulleys free from the accumulation of dirt.

The Court: But there is no water cooling there?

The Witness: There is no water cooling there whatever, and one of the purposes of the invention is to eliminate the necessity of water cooling on a moving car, where water would be very difficult to obtain.

Mr. Frye: Now, note the disclaimer while you are reading. Have you got the disclaimer there?

The Court: I take it that this would read directly on that except for the disclaimer, and with the disclaimer it probably would not. Those probably are much larger pipes.

The Witness: Undoubtedly, your Honor, this pipe (B) here is a larger pipe than would be used in a household machine. Common sense would dictate that this would be a pipe of size commensurate with the rest of the apparatus, probably an inch or an inch and half pipe, depending on just what they wanted to do; but if we were constructing this device at the present time, we would not use this pipe at all, but would use in combination with this fan, one of the small radiator type condensers that have been exhibited here in court, and it would have the small tubes of the alleged invention to Wolf.

The Court: They say, of course, because they taught you how to do that.

The Witness: Now, (d) small—this element is that put in by the disclaimer: A considerable length of copper tubing, not over 3/8 inch in diameter. This element is not found directly in the Palmer patent.

The Court: You have a considerable length, but you have got it bigger than that.

The Witness: Yes, your Honor, but obviously it would not require invention to pick out a smaller sized tube for this purpose.

Now, (E): An expansion chamber into which the liquid is expanded. The expansion chamber in Palmer is the coil of pipe (L) located within a compartment, and the air is taken and circulated around through the car by means of this other fan (C2).

(F) Said parts being connected to form a closed circuit for the refrigerant. Obviously, Palmer has a closed circuit, because all refrigerating systems using a gaseous medium except air, must have such a closed circuit.

Q. 70 Isn't the closed circuit a feature of what is known as the compression type of refrigerating apparatus?

A. Yes.

Q. 71 And has Palmer a compression type of refrigerating apparatus?

A. Yes.

Q. 72 Have you finished with claim 10?

A. Yes.

Q. 73 Will you pass on to the next claims and go on without specific questions?

A. Now, as to claim 15, we have paragraph A, the refrigerating apparatus which, of course—

The Court: You don't need to repeat where they are the same.

The Witness: In claim 15 we have one new element, or I will—one new element, the fan mounted to effect a circulation of air around the condenser and against the compressor, and in Palmer we have the fan large (C) which is playing a draft of air over the condenser pipes, little (b), and which is also, through the branch pipe, playing air out into the compartment which has to circulate around the compressor to escape. In fact, he says, it circulates in this compartment and escapes. He says: "By using the chamber within a chamber and inclosing the parts, it would be worse affected by the dust within the inner chamber, and double insurance against dust is provided as it must make its way through the cracks in the walls of the two chambers against an escaping current of air." So the pump (P) is placed within the inner chamber and must be cooled by the escaping current of air created by the fan (C). I have referred to a certain branch pipe as carrying the air from the condenser (B), as created by the fan (C) into the compartment in which the compressor is located. That branch pipe is big (F), in the patent, and leads into this chamber (D), from where the air escapes into this outer chamber, circulates around the compressor, and finally blows out at various places around the casing containing the working mechanism.

The disclaimer in this claim reads:

"The refrigeration apparatus which does not have an air cooled condenser composed of a considerable length of metal tubing of not more than one half of an inch diameter and having a comparatively thin wall."

The Court: That is the same as it was with reference to 10.

The Witness: The situation in respect to that disclaimer is exactly the same as the one in claim 10 with the exception that if we take this Palmer patent on its face and measure up the relative dimensions of this pipe as compared with the dimensions of the rest of the apparatus it may possibly show a condensing pipe of less than 1/2 inch in diameter.

Q. 74 But it is not so stated in the claim?

A. It is not so stated in the claim, and I would not care to state that the pipes in the Palmer car were half an inch in diameter, because obviously they would not use that size of pipe in that construction.

The Court: You would use a copper pipe now, about an inch probably?

The Witness: Well, if I was going to put a condenser in the Palmer device now I would use one of the small radiator type condensers.

The Court: If you were going to put the pipe in you would use it larger than half an inch.

The Witness: Not over half an inch, your Honor.

The Court: Not for that size.

The Witness: No, your Honor.

Q. 75 Do you understand that there are several coils, small (b), or a single pipe, small (b), in the Palmer patent?

A. That denotes a coil of pipe of many convolutions there, the exact number would depend on the capacity of the pump, and the area of the car, that being purely diagrammatic, and the construction of a condenser of this sort being so well known that Palmer did not any more than indicate this as an element here. In fact, the whole patent is largely diagrammatic with the exception of the specific driving mechanism to which the inventor directed his claims. He shows no details in respect to his pump and no details in respect to his refrigerating cycle or anything of that sort.

Q. 76 Is it or isn't it your opinion that any man skilled in the refrigerating art at the time of the Palmer patent would know how to make a condenser of varying sizes of pipe?

A. Yes, perfectly obvious.

Q. 77 Go on now, without further questions.

The Witness: I would like at this time to direct your Honor's attention to a patent which I believe will effectually dispose—

The Court: Have you finished with this patent?

Mr. Frye: Only 10 and 15.

The Court: I thought he was going to go right on.

Mr. Frye: We will finish one at a time and I think it will be clearer to his Honor.

The Court: And I would like to be advised with reference to each one, whether they were cited in the patent office.

The Witness: No, your Honor. Palmer is not cited.

Mr. Frye: Here are the ones that were cited. This was not cited, and I would say that all he is going to refer to are not. If he refers to any I will ask him to call it to your Honor's attention.

The Witness: As to claim 16 it is substantially the same as 15 only the fan does not play up against the compressor. Obviously that claim was meant by Palmer—

The Court: It was just omitted. So far as 16 is concerned, you would infringe whether you played it against it or not.

The Witness: Yes, your Honor. 18 is substantially the arrangement of 15 with the fan mounted to rotate about an axis parallel to the motor driven shaft. In the Palmer patent the motor is the car wheels here, the belt (I) fastens over the pulley of the axle shaft. Now, the shaft of the fan (C) is parallel to the axle shaft.

The Court: Indirectly driven thereby but not driven by the axle.

The Witness: It does not so intend in the claim, your Honor. The claim says: "And a fan mounted to rotate about an axis parallel to the motor driven shaft to effect a circulation of air around the said means."

The Court: They do have a motor in that, and in 10 you don't have a motor?

The Witness: Yes, your Honor.

The Court: That does not necessarily mean an electric motor.

The Witness: No, your Honor; it has long been held that means of motive power, it would involve no invention to substitute an electric motor here for these car wheels, to put this belt over a motor instead of connecting it to the source of power here, and naturally did not need any other source of power.

That closes the comparison of the Palmer with the Wolf claims.

(Thereupon an adjournment was taken to Thursday, March 21, 1929, at 9:30 o'clock A. M.)

Full Record of Patent Trial to Be Reprinted in Supplement

Since it will be impossible to supply extra copies of this issue and the preceding issue to those desiring a complete record of the Frigidaire-Absopure trial, Electric Refrigeration News will reprint the full report of the proceedings as a special supplement.

Extra copies of the special supplement will be available at $1.00 each, postpaid. Orders for the supplement should be entered without delay, since only a limited quantity will be printed.

PROCEEDINGS OF THE FOURTH DAY OF THE TRIAL

Thursday, March 21, 1929.
9:30 o'clock A. M.

Court convened pursuant to adjournment.

R. H. Van Deventer was thereupon recalled as a witness on behalf of the defendant, and having been previously duly sworn testified as follows:

Direct Examination (Continued)

By Mr. Frye:

Mr. Cooper: I notified the other side last evening that I would withdraw the Kramer patent and try only on the Wolf patent.

The Court: If you withdraw one more I will be all right.

Mr. Frye: We have no objection, your Honor, it is plaintiff costs.

The Court: You haven't put in any proof as to that yet.

Mr. Frye: Just general, we have not put in our main proof at all on it.

The Court: Then, to the extent that you have made Mr. Sessions your witness is the only extent to which you have put in any proof.

Q. 78 We were speaking of the various prior art patents found by you that in your opinion meet the claims of the Wolf patent in suit. You had, I believe, finished talking of the Palmer Patent, number 716091. Have you any other patents to which you refer?

A. I have.

Q. 79 Will you proceed to explain the various elements relied upon by you to anticipate the various elements and combination of claims in issue without specific questioning?

Elements in Martin and Beath Patent analyzed in relation to Wolf Patent.

A. I will now direct your Honor's attention to patent number 4992, July 16, 1872, to Martin and Beath.

Q. 80 In connection with that patent then, I would like to have marked for identification the chart I am now placing on the easel, and which we believe shows the subject matter of the Martin and Bartz patent.

The Court: I take it this is cited in your answer but was not cited in the patent office or you would bring it to my attention.

Mr. Frye: You are correct in both assumptions your Honor.

(Chart marked "Exhibit 29.")

The Witness: The inventors state that this invention relates to the cost of machines in which cold is continually produced by the vaporization, liquefaction and return for continuous use of a volatile fluid. (L) is the condenser—

The Court: That is a very concise way of stating what does happen in all these machines.

The Witness: Yes, your Honor. That is the basic thing involved. (L) is the condenser. This condenser consists of a metal casing which is really a sack which has openings for the air around the sides of it, and I refer now to exhibit 29, which is better shown in figure 1 of the patent there is holes around the base of that one.

The Court: Toward the bottom.

The Witness: Toward the bottom, and in the interior of this is a coil of pipe, (L). Now the pump is at (E) here, and the other parts of the system are those which have already been described in connection with other patents.

Q. 81 Will you look and make certain what element you desire to have for the coil, is it not the letter (G) that you intended to refer to.

Look at the patent itself, if you will.

The Witness: Yes, that is G. (L) is the condenser casing and (G) is the coil within the casing.

Now the inventors say: "Eeonomy of power in working a compressing pump requires the condenser to be maintained at the lowest temperature practicable. This has heretofore been accomplished by means of a running stream of water of 25 to 30 times the quantity actually made into ice. This large volume of water is often difficult to obtain, and is in almost all cases obtained at considerable expense. We substitute in the place of this stream of water atmospheric air only using water for the purpose of absorbing the transfer of heat from the pipes to the air the quantity actually consumed being only the small amount conveyed away in the air in the form of vapor.

"Our condenser is composed of a series of pipes (G), connected with the eduction pipe (H)" and from there he goes on to describe the apparatus.

Now, to cool this condenser he provides the vertical hollow shaft (O) which carries at its top a propellor wheel (Q) and when this propellor wheel or fan, as we have heretofore been calling it in this suit, is revolved, it does two things: First, it draws the air through the openings in the bottom of this casing, or of course it might do the reverse of that; secondly, it sprays a spray of water out of this pipe (P) here over these coils as it whirls around. That is an incidental part of the invention which bears no relation to the subject matter of this suit.

Specifies a liquid which vaporizes below the freezing point of water.

Now, this patent is very interesting as outlining rather definitely what had to be done in order to determine the physical size of this equipment in order to find out how to make it work. He says here: "In our apparatus we are enabled to use any volatile fluid whose tension of vapor amounts to a few inches of mercury at the freezing point of water; but economy in motive power and cost of machinery requires us to use such fluids as will absorb the greatest amount of heat in being converted into vapor or gas of given volume and tension,"—

The Court: Did he say that he used as refrigerant something that vaporized below the freezing point of water? Was that his statement?

The Witness: No, this patent here is very early in the art and the terms were not then as they are now.

The Court: What does that say?

The Witness: "Whose tension of vapor amounts to a few inches of mercury at the freezing point of water."

The Witness: Yes.

The Court: Doesn't that mean, then, that it vaporizes below the freezing point?

The Witness: Yes, it could be such a vapor.

The Court: Well, doesn't he say that?

The Witness: Yes, it could be such a vapor.

The Court: Well, we have not been describing those others in that way.

The Witness: No.

The Court: We have been talking about some other way of testing it, or wouldn't that test apply to all of those things that they vaporize below the freezing point of water.

The Witness: Yes, sir, your Honor.

The Court: There is not any refrigerant but what will stand that test, is there? If so, which one?

The Witness: Well, there is air itself could be used as a refrigerant, but this particular paragraph here is referring to,—

The Court: And what both plaintiff and defendant use, vaporizes below the freezing point.

The Witness: Yes, your Honor.

The Court: And ammonia does?

The Witness: Yes.

The Court: All those things you listed there, as I recall it.

Mr. Frye: We would desire to ask the witness to read into the record the statement that says he prefers to use ammonia. It is in the second claim on page 3.

The Witness: He says in the specification that they prefer this fluid to be ammonia,—speaking of the refrigerant.

The Court: He says any,—

The Witness: Any volatile fluid.

The Court: But I understand that his test is,—that is what I wanted,—any volatile fluid that vaporizes below the freezing point of water.

The Witness: You are right. (Reading.) "But economy in motive power and cost of machinery requires us to use such fluid as will absorb the greatest amount of heat in being converted into vapor or gas of given volume and tension, without having to resort to extreme low pressure to vaporize or extreme high pressure to liquefy it."

In other words, he prefers to use a gas where he does not have to create a vacuum in the low side or cooling side in order to get it to boil or too much pressure in the high side or compressor side over here.

So now he goes on to state what you must do in order to make the necessary calculations to make one of these machines:

"Having selected our fluid, we ascertain, from standard authority on the subject, its latent heat; the specific heat of its vapor; also the tension and volume of its vapor at different temperatures, from which we are enabled to calculate the amount of cold produced by the vaporization of a given quantity of liquid, the pressure required to condense it, and the volume of air required to remove the heat evolved by its condensation, usually allowing the air to be raised in temperature three or four degrees, and the water which goes with it in the form of vapor to absorb and carry about one-fourth the whole amount of heat to be removed. From the above data we are enabled also to calculate the volume of vapor or gas to be removed from our congealer by the compressing pump," —and I will inject there that the congealer is his ice making arrangement over here, corresponding to the modern evaporator,—"And the power required to work it. In the congealer the liquid uniformly increases in volume as it expands into vapor and approaches the pump, and also diminishes in volume as it recedes from the pump and liquefies in the condenser. Therefore, the aggregate sectional area of the pipe in either congealer or condenser should be sufficient to convey the gas or vapor at a velocity not exceeding 16 feet per second at any point in its course."

In other words, these inventors direct the attention of the public in their patent to the way in which the relative dimensions of the various parts of this device should be constructed.

The Court: Are you going to read those claims down to that, the claims of the patent in suit?

The Witness: Yes, your Honor.

The Court: All right.

Martin & Beath patent applied to Wolf claim 10.

The Witness: Now, we will apply this patent to the 10th claim of Wolf:

(A) "A refrigerating apparatus comprising in combination."— I think this is the same element.

(B) "Means to compress a refrigerating gas," that is the pump (P).

(C) "To a pressure the corresponding boiling point of which is above the temperature of the atmosphere."

Now, that includes ammonia, sulphur dioxide, methyl chloride and several other refrigerants.

(D) "An atmospheric condenser for condensing the compressed gas." That is the pipes (G) in the condenser (L).

Now, at this point I want to direct your Honor's attention to the disclaimer: "Composed of a considerable length of tubing made of copper of about 3/8 inch in diameter and having a comparatively thin wall."

Now, the construction of these household machines does not involve anything more than designing the machine for the particular service for which it is intended, in point of size and other characteristics. The machines are designed to fit conditions, the conditions are fixed by natural laws. The conditions are not made to fit the machines. The conditions are fixed by nature, and cannot be made an element of a combination of a mechanical apparatus. If you want a small condenser for a 100-pound ice machine, you have got to, by the very nature of the size of it, use small pipe in it. If you want a large condenser for a large machine, you must of necessity

(Continued on Page 42)

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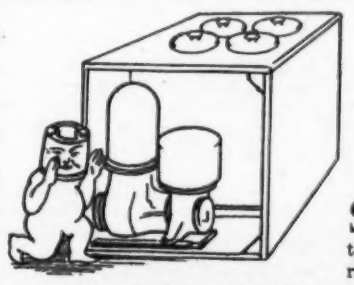

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Disclosures of the Martin & Beath Patent Reissued in 1872

use pipes which are of sufficient size to do the work.

Now, Martin and Beath pointed out in their specifications even what the rate of gas flow in this condenser had to be, and as to the meeting of the Wolf claim by this condenser here, even from the showing in the drawings here, these are small pipes. If this pump was one foot high and these condenser coils were drawn in proportion, they would be even smaller than those specified by Wolf.

The Court: Your contention, I take it, would be about the same as if someone now had a patent for ice making machines on a large commercial scale, found themselves anticipated and should attempt to disclaim and say that they limited it to pipes more than one-half inch in diameter.

The Witness: Yes, your Honor, exactly.

A. (Continuing.) Element D: "An expansion chamber into which the liquid is expanded." That is the congealer as he calls it, or the cooling or expansion coil, which is shown here. It is (BB) in figure 1. It is this tank (A) shown here in figure 2 of the large drawing on the easel.

The Court: What kind of a valve does he show to keep his pressure high?

The Witness: I will have to find it, your Honor, in the specification.

The Court: I was wondering if that was common and old in all of them, the use of about that same resource. They must have resorted to something.

The Witness: Yes, your Honor, they had to have a division or constriction between the high and the low side or between the compression and expansion sides.

Must be two valves to separate high and low sides.

The Court: And then the other place where they make the division is the pump?

The Witness: Yes, your Honor.

The Court: There has to be two?

The Witness: Yes, your Honor.

The Court: One would not be enough?

The Witness: No.

The Court: Does the pump in all of them serve—what is it that serves the other?

The Witness: In all the systems that we have been discussing of the compressor type, and particularly of this reciprocating compressor type it is in theory the same as an automobile engine cylinder only it pumps instead of doing work. The valves in the head, or one valve in the head.

The Court: Then it has two systems of valves?

The Witness: Yes, your Honor; one here and one between the evaporator and the high side of the piston. Does that answer your Honor's question sufficiently, or shall I go into the patent further?

The Court: No, I will assume, unless somebody shows me the difference that there must be two sets of valves in each of the systems from the beginning, one down by the pump and the other between the compressor and the expansion tube.

The Witness: Yes, your Honor, that is right. Now, turning to claim 15—

The Court: In other words, in this system there is one set of valves connected in some way with the pump between the compressor tubes and the expansion tubes and another set of valves between the compressor tubes and the expansion tubes.

The Witness: Yes, your Honor, that is right.

Turning to claim 15, the Wolf patent, we find the following elements immediately applying the Martin and Beath patent to them.

(9) A refrigerating apparatus including in combination—shown here in the Martin and Beath patent.

(B) A compressor, shown here at (E) in Martin and Beath.

(C) An air cooling condenser composed of a considerable length of metal tubing not more than one half inch in diameter, and having a comparatively thin wall, the pipes (G) in Martin and Beath, the exact size of this Martin and Beath not being specified, but being obvious.

(D) An expansion chamber which has the element (BB) of the Martin and Beath.

(E) Said parts being connected to form a closed circuit for the refrigeration agent.

The Martin and Beath device, like all compression systems, using a volatile gas in the closed circuit.

(F) A fan, mounted to effect a circulation of air around the condenser and against the compressor.

Now, we have the fan (G) in Martin and Beath circulating the air around the condenser. It does not circulate the air around the compressor, which has the pump, unless it would so happen that this pump, E, were placed sufficiently near the openings to the condenser shell shown in figure 1, that the air in effect drawn in would sweep over the pump, and if this exhibit number 7 is alleged to be an infingement of this claim, then Martin and Beath anticipate it, because the location of the pump in Martin and Beath could be such that the air could be drawn over the pump by the same fan, Q.

Q. 82 Whichever way the fan ran?

A. Whichever way the fan ran, either sucking air in at the bottom or pulling it in at the top, and blowing it out at the bottom. In other words, it would not require invention to call the pump, E, of the Martin and Beath, by placing it so it would be within the stream of water created by the fan Q.

Comparison with claim 16.

Now, as to the claim 16, that claim is met by this patent to Martin and Beath. With the exception of the element of the motor. There is no motor shown in Martin and Beath, but it is obvious you have to have a motor to operate the pump and the fan, and the peculiar device he has here for distributing the liquid, and the same condition applies to the claim 18, except that this claim definitely specifies the location of the fan, and in that respect Martin and Beath does not mean claim 18 of the Wolf patent.

The Court: In what respect?

The Witness: The location of the fan in relation to the motor shaft.

Q. 83 Regarding the motor which you have mentioned as lacking in claim 17—

The Court: That is, the fan is parallel to the axis of what in the patent in suit?

The Witness: "A fan mounted to rotate about an axis parallel to the motor and driven thereby, to effect a circulation of air around the said means."

The Court: The thought I had there is you can read in the motor into this, but you don't know about this, the motor is not there, and you are going to read it in, you are no worse off on that, because when you get it in you could build it to be parallel to that, couldn't you?

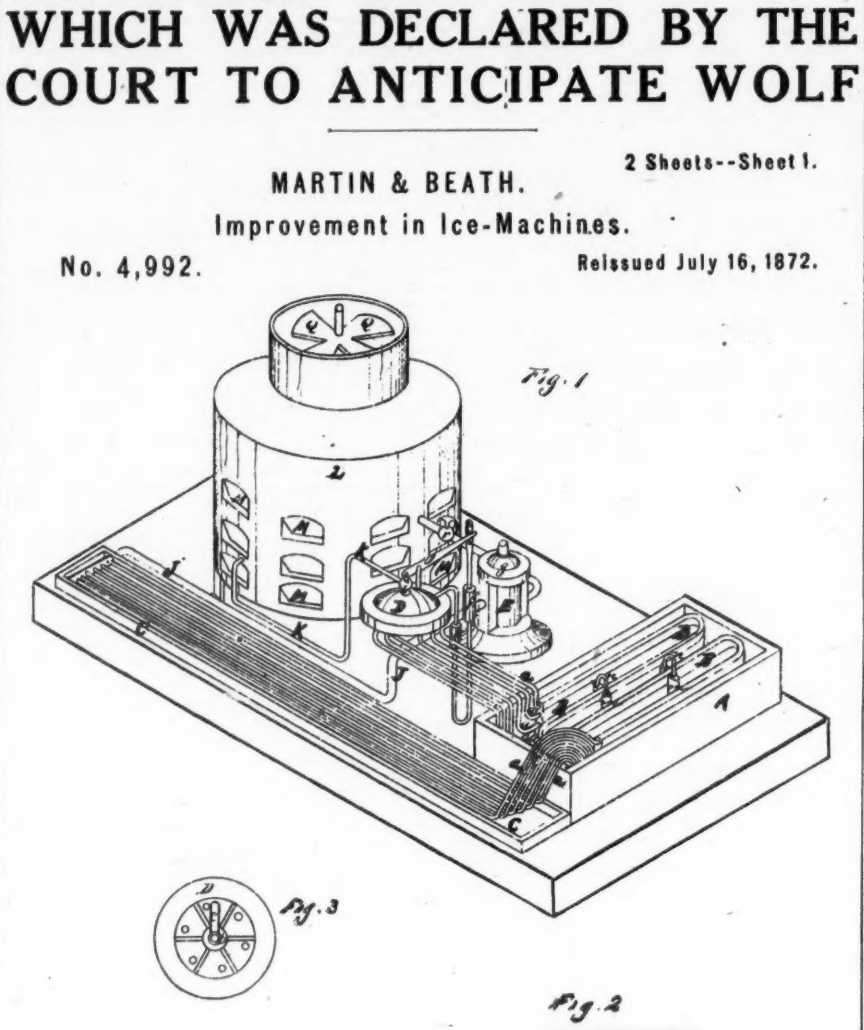
THE MARTIN & BEATH PATENT WHICH WAS DECLARED BY THE COURT TO ANTICIPATE WOLF

2 Sheets--Sheet 1.

MARTIN & BEATH.

Improvement in Ice-Machines.

No. 4,992. Reissued July 16, 1872.



One of two sheets showing diagram of the Martin & Beath apparatus from patent No. 4992 reissued July 16, 1872.

The Witness: Without the slightest difficulty, your Honor, merely a question of locating the motor in such a way that the shaft be parallel to this shaft here.

The Court: There isn't much difficulty on that any more than on the other, or much less on the other than on this.

Q. 84 Will you tell us how the patentee describes their pump (E) with particular relation to the operation of the pump?

Mr. Cooper: I notice something on the bottom of the first column of page 3. I don't know whether that is what you are looking for or not.

The Witness: It does not appear to be any detailed description of the operation of the pump in Martin and Beath, it is assumed that is the ordinary well known type of pump.

Q. 85 At the bottom of the first column on page 3 will you read the part that mentions the pump (E) into the record?

A. I have already read that paragraph in the record, but I will repeat this:

"In the congealer, the liquid uniformly increases in volume as it expands into vapor and approaches the pump, and also diminishes in volume as it recedes from the pump and liquefies in the condenser."

The last three lines of the first paragraph on page 3 where the pump E is mentioned—

Mr. Cooper: The first claim.

The Witness: The first claim, I beg your pardon. "The pump and other machinery being put into operation, a cock in the pipe (K) is opened, allowing the liquid to pass from the receiver to the distributor, D, from thence to the congealer, where it is converted into vapor by the heat withdrawn from the water with which the congealer is filled; thence it passes through the trough, C, to the pump E, where it is forced into the compressor—the condenser, through the induction pipe H, and in the pipes of the condenser it is liquefied and returned down the inclined pipes to the receiver, I, from which it is again returned to the congealer, and so on continuously."

Q. 86. Is that the only mention you find of the pump E, in the specifications?

A. I have not read this specification with extreme care in order to—

Q. 87. Well, please do so and see if you can find any other reference.

Mr. Cooper: Can't we let it go on that, if the witness cannot find it maybe counsel can. Why take the time?

There is something on the first line of page 2, if (E) is the pump.

The Witness: In addition to the part of the paragraph of the patent already quoted, the only reference I find to the pump is at the top of page 2 of the specification which states that: "E is the pump."

Mr. Cooper: Don't you find another reference in the second column of page 2 about the 6th or 7th line down?

The Witness: Yes, speaking of his particular freezing arrangement the patentees state: "In order that the freezing action may be equal in each of the plates, if more than one is used, and that it may be equal from the top to the bottom of each of the plates, it is necessary that each of the channels of plates, A, receive the same quantity of liquid, besides any considerable excess of liquid in any one pipe will be carried into the pump and there vaporized and removed by it without deriving any benefit from its vaporization."

Mr. Frye: We would like to ask the indulgence of yourself and counsel to withdraw this witness temporarily and put on a gentleman who wants to get away.

The Court: I would like to accommodate you and I am sure counsel will not object.

Mr. Cooper: No.

Sidney B. Carpender, Vice-President and General Manager, Brunswick-Kroeschell Co., testifies.

Sidney B. Carpender was thereupon called as a witness on behalf of the defendant, and having been first duly sworn, testified as follows:

Direct Examination

By Mr. Frye:

Q. 1. Will you state your residence and occupation, Mr. Carpender?

A. Residence, Clifton Avenue, New Brunswick, N. J.; occupation, manufacturer, Vice-president and General Manager of the Brunswick-Kroeschell Company, New Brunswick, N. J., and Chicago, Illinois.

Q. 2. What has been your experience and education with relation to refrigerating machines in a brief description—without any specific questioning.

A. Graduate and mechanical engineer, Cornell University 1907, specialized in refrigeration in my last year in 1907; entered the employ of Brunswick-Kroeschell Company, January 2, 1908; at that time the company was Brunswick Refrigerating Company, and they had merged with Kroeschell Brothers Ice Machine Company. I have been general manager of the company since 1912 and Vice-president.

Q. 3. Well, in the years between 1908 and 1912 were you employed within the factory or in the sales department or both?

A. Employed in January, 1908, as sales engineer and in that position my duties included the designing and estimating of Refrigerating plants that I sold. We had no estimating department. Each sales engineer in those days made his own estimates, and in 1910 I was chief engineer of the company.

Q. 4. Now in your connection with the sales, did you have occasion to prepare any catalogues that were put out by your company?

A. I did.

Q. 5. And did you become familiar with all of the other catalogues of the company, whether they were actually prepared by you or not?

A. I did.

Q. 6. I call your attention to a catalogue which I hold in my hand entitled "Well Known Users of Brunswick Refrigerating Machinery in private residences and Country Estates." I ask you if you recognize that?

A. I do.

Q. 7. Is that the one that you referred to as prepared by you?

A. I wrote every word of that myself.

Q. 8. Are you personally familiar with the sales made to various gentlemen listed on the last pages of this catalogue?

A. I am personally familiar with all the sales that were made since I came with the company, and I looked up and familiarized myself with all the details of all the orders that had been taken before I came with the company, so I am familiar with every one of those, or was at that time. I have forgotten something of it since.

Q. 9. I will ask you if this particular catalogue prepared by you was used by the company as a follow-up for preceding catalogues which also show specifically named users of the Brunswick Refrigerating apparatus?

A. It was used as a supplemental or complemental for the preceding catalogues.

Booklet on "Refrigeration in Modern Homes" copyrighted in 1908 by Brunswick Refrigerating Co.

Q. 10. I call your attention to another catalogue marked "Refrigeration in modern homes," and on the inner part of the fly leaf marked "The Brunswick Refrigerating Company, Copyrighted 1908," and ask you if you recognize that catalogue?

A. I do.

Q. 11. Can you say of your own knowledge that lists the names, and in some cases pictures of residences of actual users of the Brunswick Refrigerating apparatus?

A. I can of my own knowledge, I know every one of them.

Mr. Cooper: Are you offering these or identifying them? I wish you would, because it would be almost impossible to cross examine without it.

The Court: If you have the document given and exhibit number we can tell by the question and exhibit number what it refers to.

Mr. Frye: I was going to put them in all together, your Honor, but will be glad to do it that way.

Mark the first catalogue referred to as "Well known users," as exhibit 30 for identification.

And the one marked "Refrigeration in modern homes," as exhibit 31 for identification.

And now this one, "Refrigerating ice making machinery, the Brunswick Refrigerating Company," I will ask that be marked as exhibit 32 for identification.

Q. 12. I will ask the witness if he recognizes that catalogue and can state of his own knowledge that it was one put out and circulated by the Brunswick Refrigerating Company?

A. I do. That was printed before I came with the company, and still in use when I came with the company.

Q. 13. Now, we note in these several catalogues references to residences with refrigerating apparatus installed therein by the Brunswick company. Do you know that the Brunswick Company has sold such household or residence machines for many years?

A. I do.

Q. 14. Have they sold them practically entirely during the continuation of your employ?

A. We have sold such plants continuously.

Q. 15. How do you in selling or designing such plants, make any distinction between a household apparatus and those that are used for other duties, such as commercial, or on board a vessel?

A. There is some distinction, but only by the nature of the work required. Household apparatus is one line, meat market another, steamship another, hotels another line. The same machinery with some few modifications is used in your requirements for refrigeration, adapted to the actual purposes for which the machine is required.

Q. 16. Do you, designing such machines, build the machine to fit the conditions of its use, whether such use is in a residence or a hotel or a meat shop?

A. If you mean the machine, the complete refrigerating machine, from compressor right through expansion coils, and back again, all of which constitutes a machine, I say yes, we simply design it to meet the conditions regardless of where it is going.

Q. 17. And is practically all of the several parts the same, except for changes in size?

A. Practically.

Q. 18. There might be a difference in arrangements or dimensions, or placed various distances apart, but they all have the compressor—condenser—

A. All have the compressor, condenser.

Q. 19. Congealer.

A. And the congealer, so called.

Q. 20. Well, evaporator.

A. Evaporator.

Q. 21. Well, we have used many terms for that.

A. Or low pressure or expansion side—many terms for that.

Q. 22. Were these Brunswick household machines air cooled or water cooled?

A. Water cooled.

Q. 23. Now, have you, in your experiences in refrigerating plants, seen copper tubing of various sizes used therein?

A. Yes.

Q. 24. Have you seen it used for various purposes?

A. Yes.

Q. 25. Well now, will you give an example of one use thereof, say of a ⅜ inch diameter?

A. I cannot say specifically ⅜ inch diameter, but ⅛ up to ½ inch, in various sizes. We use today and have always used small copper tubing for our pressure gauge lines. We have used them for our small high pressure lines, in connection with our oil pipes for the glands in CO2 machines.

Q. 26. Can you tell of your own knowledge whether such copper tubes and pressure gauges can withstand or have withstood pressures as high as 500 or 600 pounds?

A. We use them for pressures up to 1,600 pounds.

The Court: What use requires such high pressures?

The Witness: Your carbon dioxide machines, where you get into, for instance, hot sea water. A ship will get up into 90 degrees sea water, some times, and your head pressures run very high then.

Q. 27. Do you know what other companies were manufacturing machines for use in residences during the years since you entered the employ of this company, in 1913?

Other companies which manufactured domestic machines prior to 1913.

A. The Remington Machine Company, Wilmington, Del., Automatic Refrigerating Machine Company, of Hartford, Conn., the Larson Baker Ice Machine Company, now the Baker Ice Machine Company, of Omaha, the York Manufacturing Company installed some few machines in residences. There may have been one or two others, who did a little work, but those are the principal ones.

Mr. Frye: Take the witness.

Just a moment: I desire to offer these catalogues referred to in evidence as the exhibits just marked with numbers.

The Court: They may be received.

Cross Examination

By Mr. Cooper:

XQ. 28. When did your company begin to make carbon dioxide machines?

A. A combined company, with the Brunswick-Kroeschell Company, was in 1922—the Kroeschell Brothers Ice Machine Company commenced to make carbon dioxide machines, I think, some 40 years ago. We combined, I think, in 1922. Our company, however, in 1919, made carbon dioxide machines under license from J. and E. Hall at London, England.

XQ. 29. Under some patents?

A. Under the Hall patents. We made their compressors under the Hall patents.

XQ. 30. Prior to 1918, you made ammonia machines?

A. Only ammonia machines, prior to 1918.

XQ. 31. Did they have small compressors?

A. The ammonia machines?

XQ. 32. The household size.

A. Yes.

XQ. 33. What size piston was the smallest?

A. The smallest we built at that time was 1½ inch diameter, 1½ by 1½.

XQ. 34. Now, if anybody should have testified in this case that such a thing was impossible, that would be a statement directly contrary to your experience, wouldn't it?

A. That would be, I would say.

XQ. 35. How about automatic control by the thermostats? Did you have that on the small machines which you have designated the household machines when you first went with the Brunswick Company in 1908?

A. Not when I first went with them.

XQ. 36. How soon after that?

First used thermostatic control about 1916.

A. We first used thermostatic control on machines in about 1916, I would say. I am not quite sure of that point. About that time, just before the war.

XQ. 37. Now, let me call your attention to one of the exhibits which have been put into this case, found in "Ice & Refrigeration," in February, 1908. Do you remember making an exhibition of one of those machines at the Electric Show held in the Coliseum, January 13th to 25th, 1908?

A. I remember that there was such an installation. That was about the time I came with the company. It is not very definite. I was just finding myself then.

XQ. 38. I call your attention to the statement in that article, "By means of thermostats, the starting and stopping of the machine, it is claimed to be made automatic so as to maintain a practically uniform temperature within the refrigerator without any attention whatever." Does that refresh your recollection as to whether you had the automatic thermostats that early?

A. When you asked me the question, I thought you meant the thermostat of the common use as of today. As I remember now, in that small machine there was a thermostat which controlled a very peculiar automatic device, which was nothing like the automatic device as of today. It was not a device for the electric starting and stopping of the machine, but there was a real thermostat used at that time.

XQ. 39. In those small machines for the household about which you have testified, did you have electric motors?

A. Were they driven by electric motors?

XQ. 40. Yes.

A. Yes.

XQ. 41. Both alternating and direct current motors, I suppose, were available and were used?

A. In those days, mostly direct.

XQ. 42. Mostly direct, but of course, alternating motors were available and were used when needed?

A. I remember very little about the use of alternating current motors when I first came with the company. I think they were very seldom used, if any, until I had been there for several years. It was practically all direct current; but after a few years the alternating current came into use.

XQ. 43. Now, did I understand correctly that throughout the course of your business, each machine is designed for its particular use?

A. No. I would hardly say that, because we built standard household machines as illustrated in that catalogue in those days, and then we also made to order the larger machines for what we called the "Millionaire" type of house.

XQ. 44. Now, what did you mean by that, in size?

A. We made machines up to two ton capacity for some of the very large households.

XQ. 45. And you are still making those for the millionaire household?

A. Still.

XQ. 46. What was the order of your output per year in what you have differentiated from the millionaire class by calling it, I believe, small household machines?

A. In the earlier years we sold many more of the standard household units and of the small partly special household units than we did of the larger machines. In fact, that was a large part of our production in the early years, the small machines.

XQ. 47. By "early years" you mean at about the time you went in?

A. 1908, 1909, 1910 and up through 1911, even.

Sidney B. Carpender Confirms Early Developments by Brunswick

XQ. 48. And what would be your output in any one of those years, of the small machine?

A. In number of machines?

XQ. 49. In number of machines.

A. Oh, 100 to 150.

XQ. 50. In a year?

A. In a year.

XQ. 51. In a year?

A. In a year.

XQ. 52. And after 1912 or thereabouts, how was it?

A. The small standard machines were not pushed as much after that time.

XQ. 53. So that your output dropped well below a hundred?

A. Yes, of those types of machines of the small standard, it dropped well down.

XQ. 54. How well down?

A. I would say down to 40 or 50 a year, roughly as I remember.

XQ. 55. And when, if at all, did the up curve start again?

A. The up curve did not start again in those machines. As the war came in we withdrew from than type of work, since we did nothing but war work in war times, and after the war we did not take it up again, because there was a different condition in the field entirely.

XQ. 56. And you never have resumed the small type of machine up to the present?

A. Only where someone happens to want one.

XQ. 57. Now, can you give us an idea of what one of those small machines, not for the millionaires, but for the common people, cost?.

Standard portable machine sold for $450.00.

A. Our selling price for these machines —may I illustrate the machine? Do you want to see it?

XQ. 58. Yes.

A. Our selling price for the standard portable machine, as we used to call it, was $450.00. That is for the New Brunswick; and for introduction purposes, I remember, we used to sell them for $365.00. I refer to this machine.

XQ. 59. That is the machine on Exhibit 31?

A. Which is the same as this machine.

XQ. 60. Referring now to page 28 of Exhibit 30?

A. This one sold for $350.00.

XQ. 61. This one is on page 22 of Exhibit 32?

A. That was a large unit as compared to this present average household machine.

XQ. 62. This last one to which you refer was the one that had a net weight of 1,300 pounds, as there stated?

A. Right; the machine and refrigerator together.

XQ. 63. And the one to which you referred of the unnumbered page of Exhibit 31 says: "Net weight of complete plant 1,900 pounds." Does that comport with your recollection?

A. It does.

XQ. 64. And the one to which you refer on page 28 of Exhibit 30 is described on page 29, at the end of the description being "If necessary, the refrigerator may be shipped in sections small enough to pass through an ordinary door way," and readily reassembled?

A. Yes.

XQ. 65. They were of the elephantine order, were they not?

A. Not for those days. They were the smallest household refrigerating machines built in those days.

XQ. 66. They were smaller, were they, than the Remington or the Automatic Company of Hartford, or Larson Baker, or the New York Company made?

A. To my knowledge, they built no portable machines. They did household work of the special "Made to order quality," but they built no portable machines. I believe we were the first and only people to build portable machines in those days.

XQ. 67. These other concerns, then, put in a non-portable installation in the houses as distinguished from your 1,900-pound machine?

A. Exactly.

XQ. 68. Were any of these machines of yours of the self-oiling sort?

A. They were all splash lubrication, self-oiling.

XQ. 69. And I suppose the butler in the millionaire's house had to do something to it?

A. Very little.

XQ. 70. Didn't he have to attend to oiling and sometimes to stopping and starting?

A. The stopping and starting of the non-automatic machines.

XQ. 71. And I think you have said that all the machines your company put out were water cooled?

A. Yes.

Mr. Cooper: That is all, I believe.

The Court: And all ammonia.

The Witness: All ammonia.

The Court: What size of expansion coils did you use?

The Witness: We used various sizes. We used some quarter-inch coils in very small wrought iron, steel tubing, we used quarter-inch steel tubing at times, and we used one-half inch, three-eighths inch, one inch, three-quarter inch, one and one-quarter inch—almost any size.

The Court: Did you use any of them in copper?

The Witness: Not with ammonia. It was thought at that time that ammonia and copper would not work well together.

Mr. Cooper: Might I ask this question:

XQ. 72. What size of coils would you use in the condensers?

A. In the condensers?

XQ. 73. Yes.

A. We used as a rule ¾-inch and 1-inch, and in some, larger coils, different sizes. Most of our condensers were double pipe, counter current condensers.

Redirect Examination

By Mr. Frye:

RDQ. 74. Does that mean there was a small pipe inside of a larger pipe?

A. Yes, the ammonia passed through the annular space between the inner and outer pipe, and the water passing through the center space, the center pipe.

RDQ. 75. Would you say there was sufficient data available to mechanical engineers interested in refrigeration to design a condenser with any size cross section of tube desired?

Mr. Cooper: If your Honor please, I think I will object to this. I do not believe it is proper redirect, and I think it is not in the line in which the witness was called to testify on facts.

Mr. Frye: He has stated he is a graduate mechanical engineer—

The Court: Overruled.

Mr. Cooper: Well, we will have another expert, and I guess I can go as far as I like, then.

RDQ. 76. Have you answered the question?

A. Yes.

Mr. Cooper: Let me hear the question, please.

(Question repeated by the reporter.)

RDQ. 77. Was such data available prior to 1913, to your knowledge?

A. Yes.

RDQ. 78. And were there tables of pressure and temperature relations and experience reports as to uses of condensers and so forth, to your knowledge?

A. There were. I would not say as to condensers, but as far as velocities and pressures, frictions, etc. I knew of no tables which specifically referred to areas of condensers, cross section of condenser piping. It was not necessary. Anyone could design them.

RDQ. 79. Anyone could compute that, could they, of mechanical knowledge?

A. Yes.

RDQ. 80. Now, you have talked briefly of thermostats. Would you tell his Honor what you know of the development of thermostats as exercised by refrigerating machines?

Automatic Refrigerating Co. of Hartford offered machines with thermostatic control.

A. I do not know the full history, nor can I connect. without refreshing my memory, the developments of thermostats from their start, but thermostats were known of when I first went into the business, were being experimented with, and long before war times—I mean the European war—they were used extensively by the Automatic Refrigerating Company of Hartford, and not extensively by others, because they had very broad patents covering the use of thermostatic control with refrigerating machines. Their name, the "Automatic Refrigerating Company of Hartford," was based on their early developments of thermostatic control for automatic operation.

Thermostats were not largely used until after the war time in refrigeration, simply because of the Hartford's patents, although they were being experimented with extensively for many years before that.

RDQ. 81. Do you know whether their cost was comparatively great, to what the present day thermostats are?

Mr. Cooper: I do not think that calls for anything but a conclusion. If the witness wants to state what the cost was at one time or another, that ought to be brought out.

The Court: Overruled.

A. The cost of thermostats in the early days were relatively great as compared to the present, yes.

Bi-metal and sylphon types of thermostats.

RDQ. 82. Now, do you know whether the general type of thermostat has changed from the days when you first went into the industry? For example, did they first use what was known as the bi-metal thermostat, and later used what is known as the sylphon thermostat? The bi-metal thermostat, according to my recollection, was first used, and I know that the sylphon thermostats are extensively used now, but also the bi-metal are used, too; and gas thermostats, you might call them thermostats, are used, too.

The Court: I am familiar with the bi-metal. What is the sylphon thermostat?

The sylphon type of thermostat is a corrugated diaphragm type, the expansion—like an accordion, the gas in there forces the thermostat back and forth.

The Court: By the expansion and contraction of gas, and not of metal.

The Witness: Of metal.

By the expansion and contraction of gas, yes, instead of metal. Two types of metal and one contracts more than the other, causing a distortion.

RDQ. 83. Would you say, as an engineer, that sylphon has to a very large extent superseded the other types you have mentioned?

A. I would say so, very largely.

The Court: In this art, you mean?

RDQ84. In the small refrigerator art.

A. Yes.

The Court: But in some other arts, not at all?

The Witness: Quite right.

Mr. Frye: That is all.

Re-Cross Examination

By Mr. Cooper:

RXQ. 85. Which of the three types did the Hartford Company have?

A. In their earlier days, the bi-metal, according to my recollection.

RXQ. 86 I suppose your business has brought you considerably into contact with butchers, hasn't it?

A. Yes.

RXQ. 87 And you are familiar on all the butchers' counters with the computing scales, aren't you?

A. I am.

RXQ. 88 You have seen that double metal arrangement of the scales for compensating purposes, haven't you, from the beginning—or are you familiar with the construction of computing scales?

A. No, I am not familiar with the constructing of computing scales. I have seen the scales.

RXQ. 89 Which kind of thermostat did your company put on?

A. We did not put any of those thermostats on in the electrical device, as I explained a while ago, but we did have some sort of a thermostat. To tell the truth, I don't know just what it was—in that early machine. As I told you, it was some peculiar device. I don't know whether it was bi-metal or what it was. It was not used extensively or successfully.

RXQ. 90 You spoke of the cost of thermostats being relatively greater in the early days. What was the cost?

A. I don't know the cost in the early days, except that according to my recollection the thermostat and the devices that were used with it, which we purchased as a whole—not just the thermostat alone, since we had to connect it with the motor —used to run up well over a hundred dollars on a plant.

RXQ. 91. Of what size plant?

A. Oh, almost any size.

RXQ. 92. When was that?

A. That was around, I would say, 1914 or 1915; whereas today we can furnish thermostats for—well, I don't know much about those prices. I know it is probably a quarter of that, $30 or $40, with their equipment.

RXQ. 93. Well now, do you suppose that the thermostat that was on the household refrigerator that your company exhibited at the Coliseum in 1908 was one of those hundred dollar affairs?

Mr. Frye: I am going to object to that.

A. I don't know—

Mr. Cooper: Well, he has answered.

Mr. Frye: He has stated he did not know what it was. It was one mounted after he entered their employ.

RXQ. 94. But you knew about the Brunswick Refrigerating Company before you entered its employ?

A. Yes, indeed.

RXQ. 95. That is, you had been in a personal way associated with it while you were still in college?

A. Yes.

RXQ. 96. And it was the expectation of going in a large way into this business that directed your studies in college to that type of engineering, as you have stated?

A. Yes.

RXQ. 97. So that you are quite familiar with its business?

A. Yes.

RXQ. 98. Now, about the size of condenser pipes which you used, those you have described were based upon your best knowledge and skill as an engineer and designer, were they not?

A. Yes.

Mr. Cooper: That is all.

Mr. Frye: That is all, Mr. Carpender. I am much obliged.

(Recess.)

H. R. Van Deventer recalled as a witness—additional testimony on Martin & Beath patent.

H. R. Van Deventer was thereupon recalled as a witness and having been previously duly sworn, testified further as follows:

Direct Examination (Continued)

By Mr. Frye:

Q. 88. Will you resume if you have anything further to say, otherwise we will pass to the next question, the next patent.

A. There are two points, your Honor, that I would like to get into the record, in connection with the Martin and Beath patent, and the one is that the pump (E) is specified in the Martin and Beath patent to be a compressing pump; and the other is a point that has to do with the water which is used in connection with the condenser. Your Honor will observe that the pipes (G), forming the condenser inside the casing (L), are sprinkled with water, which is brought up out of the receptacle at the bottom through this hollow shaft, which he says has a valve in it, and then sprinkled out at the end, at the end of this revolving pipe (P), and then flows to the bottom, and is again drawn to the top, and as I read to your Honor, he says that a very small amount of water is used. That water is recirculated again and again and is cooled by the air, so the only way this condenser is cooled is by the air, the amount of the water used being very small, as he says in his specification.

The Court: Did he say it was all vaporized, all the water?

The Witness: No, he does not say it is all vaporized, he says that: "The quantity actually consumed being only the small amount conveyed away by the air in the form of vapor."

The Court: Yes, that is right.

The Witness: But the point I wanted to make clear was the small amount of water that was used over and over again. This is not a water cooled condenser connected up to the water mains through which water flows continuously. He had a little water in there and spread it over the pipes, and a certain amount of it vaporized off, depending upon the heat of the condenser.

The Court: He pumps the water up.

The Witness: No, just pumps it up in the little revolving shaft there.

The Court: It collects in the bottom of it?

The Witness: In the chamber (L).

The Court: But there would have to be some way to supply what was taken off in vapor?

The Witness: Well, you have actually to put something into the machine from time to time to do that, you have to put some in.

The Court: What is provided for the receptacle for the water supply? Is there anything said about that at all?

The Witness: Yes, your Honor. Speaking of this fan, he says: "This shaft is revolved with sufficient velocity to force the water with which it is charged down to the hollow arm which descends in the form of spray over the coils of the pipe (C), while the propeller (Q) draws the air in through the side openings, and forces it in a gentle current out at the contracted top of the case. Water falling on the floor of the condenser runs to the center and is again drawn into the shaft, and so continuously circulates, the water serving as a medium through which the heat evolved by the condensing gas is subjected to the air through which it is constantly passing as it falls."

The Court: You don't get any idea how much water is in there to start with?

The Witness: No, your Honor.

The Court: Could you give me some idea of that?

The Witness: That would depend, your Honor, upon how long you wanted the machine to run without putting any water into it. I should say, if you constructed that condenser to use water at all that you would have to supply it with probably, under ordinary summer conditions, a half gallon of water a day.

The Court: Fill it once a day, probably.

The Witness: The amount of evaporation that would take place would probably be due more largely to the fanned air current than it would to the condenser heat.

Q. 89 Now have you any other patents that you describe that you desire to mention in connection with the claims of the patent in suit?

Leslie patent No. 493036

A. Yes, I call your Honor's attention to United States Patent 493036, the Leslie patent.

Q. 90 Under the file wrapper was that cited by the Examiner?

A. No.

Q. 91 Is it mentioned in the answer?

A. Yes.

This patent relates to a class of devices adapted for supplying cold air to a room or office, and the object is to provide a portable apparatus, and naturally it must be relatively small in size, and have the other characteristics of a domestic appliance.

The Court: For artificially cooling the room?

The Witness: Yes, your Honor.

The Court: Not very cool.

The Witness: Well, it is a matter of degree, your Honor, how large you made the various parts.

The Court: But it is designed to put into a room to keep it cool enough to keep it comfortable in hot weather.

The Witness: Yes, your honor, that is the purpose of the invention.

The Court: That is a matter of degree.

The Witness: Entirely so, your Honor.

Now, he constructed this device by providing a cylindrical casing, and in this casing he mounted two or more cylinders, which are marked little (d) here in the drawing, which correspond to the expansion cylinder or cooling tank which is inside of the refrigerator compartment, and in the middle of this large cylinder here or casing, he mounted a tank marked big (F) in the drawing, which constitutes his condenser. Between the cold side and the hot side of this machine he put a wall here, big (E), which continues on out, as he says, to the outer atmosphere.

The Court: That would be the atmosphere outside of the room?

The Witness: That would be the atmosphere outside of the room. You have got to get rid of the heat, you have got to take it out the same as you do from a stove.

Now, he has a motor here marked big (C), and on the shaft of this motor he mounts two fans, one of them the fan little (b), projects into the casing, containing the condenser which is connected to the outer air.

The Court: The hot air.

The Witness: The hot air.

The other fan, big (B), takes air from the end of the casing which is in the room, blows it across the coiling tanks, or coils, and out into the room, thereby cooling the room.

Now that is the invention of this apparatus.

Now, it has long been understood and well known in this art, that tanks and coils were interchangeable so far as evaporators and condensers were concerned. The choice of a coil or a tank for your evaporator or condenser is largely a matter of mechanical design and depends on a number of factors. Those factors have little or nothing to do with the issues in this suit. In other words, this tank (F), could just as readily be a coil of pipe and so could the tanks little (d) here.

Now I will proceed to apply this patent, element by element to the Wolf claims.

The Court: You have two sets of valves there.

The Witness: Yes, your Honor, you have the bottom—you have exactly the same thing that you have in the refrigerators here in the room in so far as the refrigerating system is concerned. You have a compession pump, and of course it must have this valve to operate, and you have an expansion valve here, which I think is described and shown in detail in the patent.

The Court: The expansion valve is at the other end, isn't it?

The Witness: Yes, your Honor, on the low side. It says that large (G) is his gas compressing pump, the induction pipes, little (g) act with the expansion chamber (D), and the eduction pipe (CX) with the holder (F) at the end of the apparatus opposite to that where the pipe little (f) is connected. He says that a valve (F), prime, is provided to regulate the flow of the gas from the holder (F). This is the valve, violet colored, at the right hand end of the picture on the easel. There are a few parts of the specifications I will read to your Honor, although they duplicate the simple explanation I have given, I believe it will be necessary to get them in the record. He says the casing (A) may extend indefinitely to the left, as the apparatus is represented in figure 1, and will take air from outside of the room by preference in order that the supply may be fresh. The motor (C) will be connected in circuit with any form of generator. The fan, large (B), will cause a current of air to flow along and through the annular passages, little (a), finally emerging at the other end of the casing, big (A), so the latter, as well as the receptacle, big (D), and the holder, big (F), may be of any length.

The pump, (G), will take the expanded gas from the expansion chamber, little (d) and force it into the holder, (f), thus maintaining the compression in the latter. The compression will heat the holder (f), which will radiate its heat to the air within the annular space, little (c), between the holder, (f), and the inner casing big (E), and this warm air will be displaced by the following described means: On the shaft, big (C) of the motor, is a small exhaust fan, little (b), which rotates within the inner casing (E), which extends out to or nearly to the fan.

The Court: Does it blow the air across the motor except that it sucks it across?

The Witness: Yes, your Honor, the motor is, instead of being in front of the fan it is behind it. The wheel, little (k), extending through a slot in said casing, to reach the pinion, (N).

The Court: This air comes out of the room that is taken in?

The Witness: He says preferably this casing extends outwardly so the air may be fresh, so the air which is circulated by both these fans is the external air.

The Court: The outlet, of course, of the cold air is into the room, but the intake where the air that passes over the cold chamber, I suppose is preferably from the outside, the air that passes over the cold chamber, and what passes over the hot chamber, that is preferably from outside.

The Witness: Yes sir, preferably from outside.

The Court: And exhausting what passes over the cold chamber into the room, and what passes over the hot chamber out of the room.

The Witness: Yes, they are separated and go their respective ways.

The Court: So it would be not only a cooling process, but a ventilating process as well, it would change the air in the room, I take it.

The Witness: Yes, your Honor, and these old devices are now being resurrected and commercialized and going into commercial use.

This fan (B) causes the air to flow through the annular passage, (O) in the direction of OY, said air being carried away by a flow OX, which forms a continuation of the passage, O, and which may lead the warm air out of the room or to any point desired.

Now he says that he prefers to make the casing, big E, in whole or in part the same non heat conducting material, in order that the heat from the passage O, may not be transmitted to the passage A. In other words he puts the heat insulating wall between the high and low sides of the machine so he will not be lifting himself by his boot straps.

"I prefer to arrange the compression pump within the casing, A, and the motor also."

In other words, he makes a self contained unit out of this thing.

"But this arrangement is not absolutely essential."

Now, as applied to the claims of the Wolf patent, we have here the refrigerating apparatus, we have the compressor, we have the gas condensed by the compressor, we have the expansion chamber and the closed circuit, and the air cooled condenser, less the ⅜ inch pipe.

The Court: The fan?

The Witness: Going on to claim 15 we had the compressor and the expansion chamber in the closed circuit, and the fan.

Now, claims 16 and 18 included a motor, and we have the motor here, so that we have in this patent, with the exception of the ⅜ inch copper tubing, everything that there is in the Wolf patent.

The Court: What kind of a refrigerant do they use in the Leslie patent.

May employ any of the well known chemicals which, after compression, will produce intense cold by their expansion.

The Witness: He says here: "I propose to employ any of the well known gases or chemicals which may be compressed and will produce intense cold by their expansion. Of these carbonic acid and ammonia will serve the purpose."

Now this patent was filed in 1892, issued March 7, 1893, and sulphur dioxide, the particular refrigerant on which great stress was laid by the patentee, Wolf, was well known at that time, and Methyl Chloride, as used by the defendant, was also well known at that time.

The Court: What kind of compression tubes did he use—that is a cylinder, and what did he fill it up out of?

The Witness: This tube?

The Court: Well, it is at the most, a cylinder, isn't it?

The Witness: Well, it probably took the form of a cylindrical vessel, probably three to four inches in diameter, and four feet long, or something like that.

The Court: What was it made of?

The Witness: I imagine, if he used ammonia, it was made of a steel tube.

Q. 92. You have stated that every element found in the claims of the Wolf patent are found in the Leslie patent before you. Do you find them in combination in the same patent?

A. I do.

Q. 93. Now I would call your attention to the mounting of the fan, small (b), with relation to the motor shaft. How is the fan mounted there?

A. The fan in the Leslie device, and I am speaking now of the fan cooling condenser, (F), is mounted to rotate about the axis of the motor shaft.

Q. 94. It is fastened on the shaft, small (c), is it not?

A. It is, yes sir.

Q. 95. Which is the motor shaft?

A. That is correct.

Q. 96. Now I call your attention to plaintiff's exhibit No. 7, defendant's machine, and ask you to tell on the record how the fan is mounted in that device?

A. The fan in the exhibit to which you call my attention, is mounted upon the motor shaft, and the arrangement is identical with that shown by Leslie.

Q. 97. Now I call your attention to claim 18 of the Wolf patent where a statement is made as a part of the claim, reading from the top of page 4: "And a fan mounted to rotate about an axis parallel to the motor and driven thereby." Is either the fan in the defendant's machine or the fan in the Leslie patent parallel to the motor in a strict mechanical sense?

A. It is not. They are co-axial, not parallel. They are not displaced laterally.

Q. 98. When two lines are parallel they are separate from each other, is that correct?

A. They must be to be parallel.

Q. 99. If the two lines are moved together into coincidence, they become what is termed axial, do they not?

A. They do.

Q. 100. Would you describe the mounting of the defendant's fan, and the mounting of the fan, small (b), in the Leslie device as co-axial rather than parallel?

A. I would.

Q. 101. But if either are parallel, both are parallel in your sense of speaking, is that your contention?

A. That is right.

Q. 102. Now, have you completed what you want to say about the Leslie patent?

A. I have.

Q. 103. Have you any other patents relating to the claims of the Wolf patent in suit to which you desire to call attention?

A. I have.

Mr. Frye: I have erred again, and I desire to offer this large chart of the Leslie patent, Number 493036 for identification as exhibit 33.

Q. 104. What patent are you now referring to?

Patent No. 328784 to H. C. Johnson.

A. Patent of H. C. Johnson, Number 328784. This patent shows a refrigerating apparatus that may be used.

Mr. Frye: Just a moment. Is this patent mentioned in the answer of defendant?

A. Yes.

Q. 105. Is it mentioned in the file wrapper before the patent office?

A. No.

Q. 106. Now proceed, if you will.

A. This patent relates to a refrigerating apparatus which may be used in a car, boat, or other means of conveyance, and it may also be used in stationary outfits, and the numeral, 2, represents a pump, driven by any suitable power so as to compress the ammoniacal gas into a radiator, 3, which may be of any usual form, and I call your Honor's attention to the employment of the word "Radiator" for the first time in these reference patents.

The Court: I don't see the figure 3, but I see the radiator all right.

The Witness: The figure 3 is right along side of it, in figure 1.

The Court: Yes, I see it now.

The Witness: I will continue to quote from the patent: "Radiator, 3, which may be of any usual form, for example, a coil of the requisite length of radiating surface to cause the compressed gas to be cooled to atmospheric pressure to sufficient expedition. Fans and water evaporation, or other means may be applied to the external surface of this radiating coil to assist in cooling the compressed gas."

Now, your Honor, the patentee gave a rather definite indication there of what to do to produce this radiator. He said you should make a coil the requisite length of radiating surface to allow the compressed gas to be cooled to atmospheric temperature.

The other elements in the patent are the usual and ordinary elements, made with any refrigerating system, and I will

Operation of the Audiffren Machine Described

now apply this reference to claim 10 of the Wolf patent.

(A) A refrigerating apparatus we have in the Johnson patent.

(B) Means to compress the refrigerating gas is the pump, 3, of Johnson.

(C) Compressing the gas to a pressure, the corresponding boiling point of which is above the temperature of the atmosphere, that is made by the lines 16 to 18, page 1, and

(D) An atmospherically cooled condenser for condensing the compressed gas. That is the radiator, 3.

A disclaimer referring to the ⅜-inch pipe limiting that, but its limitation is not found in the Johnson device, but his language is unmistakable.

The Court: The lines indicate it is pretty small.

The Witness: Not only does the drawing indicate that, your Honor, but the very definite common sense instructions he gives in the first paragraph on page 2 of this specification also. Now, element E is an expansion chamber in which the liquid is expanded. That is pipe 5 in the Johnson patent.

The Court: He expands the gas into what?

The Witness: Into the pipe 5, figure 1 of the patent. That is the usual ice house or expansion chamber coil.

The Court: Does 5 continue on down to the coils below it? What are those coils below 5?

The Witness: In the same figure, your Honor?

The Court: Yes, are they a part of 5?

The Witness: Yes, all of that coil with the arrows in it, all of the coil within the building is 5.

The Court: All this is 5?

The Witness: Yes, your Honor, everything in the building is 5.

The Court: It just does not show the other end of the pipe, the curved end where it comes back in?

The Witness: I think you will find that right on top of the compressor. Look right above the numeral 2, a little to the left of the letter (C) and you will observe that the pipe, the last length of pipe, the bottom pipe continues to the left that connects to the compressor as it goes by and runs out of the building, so that the car line, 15, and the valve, 16, can connect therewith.

The Court: This is a continuous pipe?

The Witness: Yes, your Honor, that is the ordinary evaporator.

Now, element, F, is that the parts are connected to form a closed circuit for the refrigerant. Of course that is present in the Johnson patent as it is in all other compression systems.

The Court: What is the purpose of having so many coils?

The Witness: He says here that these may be used either to charge up cars, according to this system he has got, or else in a cold storage warehouse, and the showing, figure 1, would be that of a meat storage or other low temperature cold storage warehouse room, where the evaporator coils are widely separated, because the entire cubical contents of the room is to be cooled.

The Court: This is a continuation of this tubing right around in it—

The Witness: He charges up that car with the refrigerant, and then cuts it off and lets it go on its way, and lets that car become a little refrigerator of its own until it gets to the next station, and then it is recharged again.

The Court: The car, after it gets away, would have no heat—when the heat of the car all finally got into the tube—

The Witness: Yes, your Honor, and then they would take that charge out and put in another one. That is merely one of the objects of the invention.

The Court: But, to think of it in connection with this patent, we would not have the car, figure 1, in it at all, if you have that as a cooling room in which the pipes are.

The Witness: Yes, purely as in the case of a cold storage warehouse.

The Court: There is no fan on this?

The Witness: No, your Honor, there is no fan, although he says in the specification that he can have one. He says: "Fans and water evaporation or other means may be applied to the external surface of this radiating coil."

The Court: And he uses the motor?

The Witness: Yes, your Honor. "Numeral 2 represents an air pump driven by steam, water, or any suitable power to compress the ammoniacal gas in radiator 3."

The Court: The wheel that was there goes with the pump?

The Witness: Yes, I take it that is the flywheel of the pump.

Q. 106. Now you have applied the Johnson patent to claim 10 of the Wolf patent only. Now is that the only claim of the Wolf patent to which you desire to apply the Johnson patent, and if so, why?

A. The remaining claims in suit in the Wolf patent all refer to a fan.

Q. 107. Specifically includes the fan as an element, is that it?

A. They do, with the Johnson patent, with this very definite statement: "Fans and water evaporation or other means may be applied to the external surface of this radiating coil to assist the cooling of the compressed gas."

It certainly requires nothing more than ordinary human intelligence to put a fan on the Johnson radiator.

Q. 108. But the fan itself is not disclosed by drawing in the Johnson patent?

A. Was not; it was entirely obvious, and not necessary to disclose.

Q. 109. Have you any other patents in connection with a claim of the Wolf patent in suit which you desire to call to the attention of the Court?

Audiffren and Singrun machine compared to a dumb bell with one end hot and the other end cold.

A. I have, and the next is number 898400, Audiffren and Singrun.

Mr. Frye: I move to have the chart enlarged of this particular patent 898400, marked for identification, Exhibit 34.

(Chart referred to marked for identification Exhibit 34.)

A. (Continuing) Now, if your Honor please, the machine shown in this patent is exactly the same in principle and operation as the other machines that have been described, but the physical construction of it is considerably different, in that the whole machine with its pump and its condenser, and its expansion coil or tank, all revolves, if you can visualize a big dumbbell, one end of which is cold and the other end hot, then you have a rough idea of what this Audiffren Singrun machine looks like. That is all you see when you look at it. You see these two large drums, one of which is hot and the other of which is cold.

Now, inside of this body is mounted the usual compressors, which in this particular machine they had two or three cylinders, as many as they wanted; and in the other end, the cold end of this machine, they had a tank here, and they could rotate this in brine, and cooled the brine and then take it off into whatever they wanted to with it.

That, I believe, will be satisfactory to counsel so far as the description of the operation of the Audiffren machine. Is it necessary to go into the detailed construction of the Audiffren machine?

Mr. Frye: I think that is up to his Honor. If your Honor understands it, I desire to cut the description.

The Court: Why don't you go into it?

Q. 110. Before you do that, though, let me ask you if that patent has been mentioned in the answer?

A. It has.

Q. 111. Is it mentioned in the file wrapper at the patent office?

A. It is not.

Q. 112. Now, proceed as his Honor desires.

The Court: Perhaps this would be a good place to stop.

(Whereupon a recess was taken until 1:30 o'clock p. m., same day, Thursday, March 21, 1929.)

Afternoon Session
Thursday, March 21, 1929,
1:30 o'clock P. M.

Court convened pursuant to recess.

The Witness: In conection with the description of the Audiffren machine, the machine in the United States patent number 898400, I have here another drawing of the Audiffren machine, which will perhaps give your Honor a better view of the external appearance. It is somewhat larger than the ones in the corresponding United States patent. This French patent is number 372886.

Mr. Frye: Your Honor, I move to have the enlarged chart to which the witness has referred marked for identification.

Mechanism in Audiffren machine causes compression as the dumb bell rotates.

The Witness: (Continuing) We have this rotating dumb bell, one end of which is the high side of condensing means, also containing the pump or compressor, and the other side the hollow side or cold end, and this is mounted in a casing. The cold end dips into some brine or other solution here, which becomes cold, which is circulated, anyway through suitable pipes. The hot end, containing the cylinders and all of the mechanism, is so positioned inside the dumb bell that the rotation of the entire machine by means of this shaft will cause a compressing action to take place. The weight of the cylinders and mechanism will keep it in one position, and the shaft revolves around in the whole machine, and that causes a pumping action to take place.

The operating of the machine is exactly the same as any other compression type machine, and this particular machine uses SO2.

Now, the particular features of it which refer to the claims of the Wolf patent are the condenser and the method of cooling. Now, the condenser consists of this hollow shell (B), into which the hot compressed gases from the pump are discharged. That, in rotating, dips into a quantity of water, the lower part of this casing, and then this surface, in its rotation, is exposed to air which enters at 8, and which is drawn into and over the surface of the condenser by means of the fan 7. This fan 7 is driven by a belt from the main shaft of the machine, and your Honor will observe that the main or motor shaft is parallel to the fan shaft.

Now in the French patent here, number 372886, we had two fans here which caused an increased circulation of air.

The Court: On pulling it out and the other pushing it in?

The Witness: As shown by the arrows. Now applying this patent to the Wolf, your Honor will observe that we have here everything except the coil condenser, and at this point I would like to introduce a patent—

The Court: Of course they have to have a motor but it is not shown there?

The Witness: No, your Honor, he shows no motor, he says in here that this shaft is driven by suitable means, which of course is obvious.

At this point I would like to refer to a French patent, number 401989.

The Court: There is neither suspension or expansion coils in this, is there?

The Witness: No, your Honor, they are both tanks, which are interchangeable with coils, for other reasons that are not before us here.

Mr. Frye: At this point let me ask the witness whether the French Audiffren patent number 392388 is set up in the answer.

The Witness: Yes.

Mr. Frye: And is it mentioned in the file wrapper before the patent office?

The Witness: No.

The Court: This is the Frenchman you are talking about.

Mr. Frye: Yes, your Honor.

The Witness: Now, with respect to the last French patent, 401989, that is another French patent—

Mr. Cooper: Is that something set up in the answer?

The Witness: No.

Mr. Frye: We move to have it marked for identification as exhibit number 36.

The Court: I suppose it may be admitted for whatever advancement it may have on the art.

Mr. Frye: I understand this is an example of the use of the coil in a way similar to that of the Audiffren.

Mr. Cooper: Is it a copy of a patent that we can see, or is it a secret? Is it something that we can see and study?

Mr. Frye: I would like also at this time to offer a certified translation of the French patent number 372886.

The Court: That is the one you are talking about, the one you were talking about before?

Mr. Frye: That is the Audiffren French patent. We haven't an official translation of the second French patent to Fascio, but we have had one made by a translator, and will be glad to have it checked and wish to reserve the right to substitute a certified translation.

Mr. Cooper: Why have a certified translation before we have any opportunity to investigate it while the trial is going on? We are not going to waive any question about a translation that seems to be correct, but it is a question of fair play.

The Witness: I will state I am only going to use this patent to show one thing, and I think everybody will agree that is obvious after I have explained it to the Court.

Mr. Cooper: Well, I won't.

The Witness: This patent shows one of those revolving machines which were a favorite type with the farmers, and this patent is of date 1909, along about the same time as the Audiffren patent, which was September 8, 1908, and in the Fascio patent, instead of the rotating cylinder containing the mechanism being a chamber, as shown in the Audiffren patent, it is a set of coils bearing the numeral 9.

Mr. Cooper: Is that an expansion chamber you say?

The Witness: That is the condensing chamber of the refrigerating machine.

The Court: That whole thing revolves like a merry-go-round?

The Witness: Yes, your Honor, all the coils sweeping through the air it is cooled thereby. The interchange of coils and tanks in this art is so common and so well understood that from the standpoint of patents very little particular mention is made of it; it is well understood by engineers that where you are using the coil in one machine you can use a tank in another, depending on various mechanical reasons which do not enter into this suit. Coils work best with some refrigerants and tanks work best with others. They developed a number of these small machines like the Audiffren machine, very much on this same order, though merely cooling water. I have seen the machine of this general type, about this high, about 18 inches high, and about twelve inches in diameter, that could be, for instance carried into the tropics on an exploring expedition and operated by hand to produce a limited amount of cold. They are very small, and of course very inefficient machines.

The Court: I did not get the date of that Fascio.

Mr. Frye: Will you read that, please?

Mr. Sessions: Dated the 23rd of September, 1909.

The Witness: That concludes the anticipatory patents in respect to this.

(The witness thereupon resumed the stand.)

Q. 112. Now, there has been considerable talk in this trial concerning small tubing, ⅜ inch tubing, or sizes that we considered relatively small. Now, I wish you would tell us if you have found any patents that to you would appear to indicate the disclosure of small tubing in refrigerating apparatus. I would like you to schedule say three or four, if you have them available, with not too much comment and without specific questioning; and at the same time, mention whether the patents referred to are included in the answer or included in the file wrapper?

Witness suggests that spigot on Coleman water cooler would indicate use of ⅜ inch tubing.

A. The first patent to which I would direct your Honor's attention is number 726217, to Coleman.

The Court: Now, the date.

The Witness: April 21, 1903.

The Court: All right.

A. (Continuing) The title of the patent is "Refrigeration System," and the patentee states that the "Invention relates to refrigeration systems in which the refrigerant medium is positively transferred from the cooling chamber in an automatically controllable manner," and he illustrates an ordinary household water cooler.

Mr. Cooper: I would like to have it noted that this is another patent that is not pleaded, as far as we can observe.

Mr. Frye: I thought it was included in the question that the witness was to mention that, if it were in the answer or not.

The Witness: This is not in the answer. It is explanatory and not anticipatory.

The Court: Not cited in the patent office, is it?

The Witness: Not cited by the patent office.

A. (Continuing) He describes in this patent the same elements that we have been over in connection with the other patents, that is to say, a compressor and the motor and an expansion coil, and then he describes his condensing chamber. He says, "That the refrigerant medium passing through pipe connection 10, into the condensing or storage chamber 1, for subsequent re-use, in the process of refrigeration."

Now, he mounts this condensing chamber or storage coil 1 directly upon the cover of the water cooler, and in continuing his description of the operation of the apparatus, he says that the refrigerant medium is compressed in the upper part of the receiving or separating chamber 8, from whence it passes through pipe connection 10 to the storage chamber 1, to be again expanded into expansion chamber 2, in the continued operation of the apparatus."

And that is about all he says about his condensing chamber because it was a well understood, obvious thing, and it is not something which he was claiming in here; so he just made the usual necessary description of it, to indicate what part in his drawing the condensing chamber or storage coil was.

Now, if your Honor will look at the drawing, figure 1 of this patent, you will see that it is an ordinary water cooler of the average size that water coolers are commonly made and I think that your Honor will take judicial notice of the fact that the spigots on water coolers are about one-fourth to three-eighths of an inch, seldom larger than ⅜ of an inch. We have a water cooler here in the court room, which is, I believe, a typical water cooler, in common use.

Now, if your Honor will please look at the condensing coil, figure 1, on the top of this water cooler, it will instantly be appreciated that the diameter of the tube contained in that coil is smaller than the diameter of the tube of the spigot shown in the drawing, and it must be ⅜ inch or less in diameter. The total diameter of these water coolers seldom exceeds 14 to 18 inches, and it would be absolutely necessary to use a coil of about that diameter in order to get sufficient turns and sufficient lengths as taught by many patents in the prior art, to produce the necessary condensing surface; and another thing is that it would be extremely hard, from a mechanical standpoint to use anything else but copper tubing of relatively small diameter to form a coil of that peculiar cone shape.

The Court: Did he say it was of copper?

The Witness: He did not. He does not mention any metal at all, but he would have had to have worked very hard to find out something else to make that particular coil out of.

The Court: What kind of a refrigerant did he use?

The Witness: I do not believe he states.

A. (Continuing) His patent is directed to the details of the water cooler, and all these other things he merely mentioned sufficiently to illustrate his invention.

Mr. Cooper: But he says at line 46 of page 1, "Such as ether or other analogous fluid or vapor."

The Witness: Ether is in the same general class of refrigerants that we have been discussing here, and its use has been known for years.

A. (Continuing) I will now call attention to U. S. patent 85719 to Tellier.

Mr. Frye: Just a moment, Mr. Witness. I desire to have marked for identification the Coleman patent to which you have just referred.

(The Coleman patent was thereupon marked "Exhibit 35" for identification.)

Q. 113. Is the Tellier patent mentioned in the answer?

A. Yes.

Q. 114. Is it mentioned in the file wrapper or the patent office?

Tellier patent mentions size of tubing used.

A. It is not. In connection with this patent, your Honor, I wish to observe that the question was asked me yesterday by counsel if, in looking over the many refrigeration patents in the prior art, I had found any reference to the size of the tubing used, and my answer was "No." It so happens that in this Tellier patent, I do find a reference to the size of tubing.

The Court: All right.

The Witness: This patent is for an ice machine.

The Court: Like that. (Pointing to illustration.)

The Witness: Yes, your Honor. I am going to refer particularly to the refrigerating tube, A. If you will turn the sheet this way, your Honor, you will have these things setting on its base. This shows a compressor, a cooling coil and a condenser.

The Court: Off to the left.

The Witness: The cooling coil is on the left of the figure, and a condenser.

The Court: Off to the right.

The Witness: The condenser down at the bottom underneath the floor line there and it shows a fan or blower on the extreme right, you can see the belt projecting toward the upper edge of the sheet.

Now on page 3 he describes this refrigerating tube. I should have said that the tube, A, is the low side instead of the high side of the system. It is the evaporator. He is using this to blow cold air somewhere.

The Court: Are there two figures, figure 1 and figure 2?

Mr. Byrne: Yes.

The Court: I don't see where it says figure 2; where is that?

Mr. Cooper: Just below the loop there.

The Witness: The top figure is figure 2.

Mr. Frye: When the patent is turned sidewise.

The Witness: Yes.

Mr. Cooper: Here is figure 1, and that is not on here at all.

Mr. Frye: This is the unnumbered figure to which you refer, witness?

The Witness: It is.

The Court: If I turn it over this way I get a figure 1, if I can read. I don't understand this.

Mr. Frye: Well, your Honor, there is only one quotation, as I understand, in this patent, and it can be made very quickly, and I think would be obvious.

The Witness: There are two figures shown in this patent here.

The Court: You are talking about sheet 1?

The Witness: Yes, your Honor, the unnumbered figure. Now this unnumbered figure has an evaporator or cooling coil, or as he calls it in the patent, a refrigerating tube, A, which is made of an iron cylinder forming a strong iron jacket within which are lodged a number of small tubes, half to ¾ of an inch in diameter, part of which may be seen X, X, X, X.

Mr. Frye: Now, will you show his Honor specifically where the lines quoted are?

The Witness: Yes. (Indicating to the Court.)

The Court: All right.

The Witness: Now, bearing in mind that it is an old established practice to have evaporators and condensers of substantially the same construction, that is to say, either tanks or tubes or coils, your Honor will at once perceive that the disclosure in this patent disposes once and for all of the contention respecting the ¾ inch tubing, because to take this evaporator here and use it as a condenser, it is merely reversing its use, instead of making something cold with it you are putting something hot inside of it and blowing the air through it, and cooling it, in other words the same device of course, probably without much change could be used as a condenser, in fact, in many machines there is no difference between the compressor and the evaporator, which we will proceed to show your Honor from other patents.

The Court: This is on the expanding part of the machine?

The Witness: Yes, your Honor, that is the expansion tank down there, and he blows air through that and cools the air thereby. Now, if instead of putting the coil—

The Court: Why would you want the cooling air after you expanded it?

The Witness: This cylinder full of tubes here is like the Leslie patent, where you blow the air over the cold tubes to cool the room, and his is doing the same thing here.

The Court: He is making use of his cold air after he has got it cold?

The Witness: Yes, your Honor, that is it.

The Court: This does not say whether they are copper or what it is.

The Witness: No, your Honor. I have not studied the patent—

Mr. Cooper: It speaks of methyl ether. Does not that limit you as to your choice of metals?

The Witness: No. What has that got to do with it?

The Court: It was probably then iron or steel he was using, whatever he would be likely to use at that time with methyl ether.

The Witness: I don't know what he meant when he said methyl ether here, in 1869, I am not a chemist, I don't know. The terminology or phraseology of the language of refrigerants has changed considerable since that time.

Mr. Cooper: Well, he tells how to make it in the last paragraph, 3.

Mr. Frye: There is mentioned an iron cylinder and he does not mean the material of the tubes, but they are placed within the iron cylinder, and I think you can form your own judgment concerning that.

The Witness: If he was using ethyl chloride, methyl ether, or ethyl ether, or any of the others that I know of, copper tubing or metal tubing of substantially a thin wall would be amply sufficient to hold the pressure, if that is the point you make.

The Court: What was the corroding action of these ethers in the early days?

Mr. Frye: If you know?

The Witness: With methyl or ethyl, no, with ethyl or methyl ether there is no corrosive action. I don't know about the other ethers.

Patent No. 692962 to Worth.

Now, we have another patent here, number 692962.

Mr. Frye: Is that set up in the answer?

The Witness: It is.

Mr. Frye: Was it mentioned in the file wrapper before the patent office?

The Witness: It was not. It is issued to Worth, et al. The title of this is "a cooling or condensing coil." The inventors state that "The invention has reference to improvements in cooling or condensing coils, and relates more particularly to coils that may be made a part of a water circulating system adapted to be used with gas engines for the purpose of carrying away and dissipating the waste heat evolved from the combustion of the charge, which would otherwise heat the cylinder of the said engine to a dangerous degree. There is no difference in use here than in the refrigeration machine, it has a condensing coil for the purpose of carrying and dissipating the heat. That is just what a condenser in an ice machine does. Now, he shows a circular formation for his condenser, and it is obviously from the drawing, figure 1, a continuous length of tube coiled up in a spiral or snail-like form, and he says:

"Pipes shown comprise a path for the circulation of the cooling water in gas engines. As the water becomes heated in the water jacket it will flow into the coil pipes, B-2, through the header E prime, and the pipe B."

And he goes on to say that, "when the wheel A prime, is driven at its normal speed the ribs, A-4, will beat the air and cause a circulation of air around the coils B-2. Such a circulation is introduced by the difference in the velocity of air confined between the ribs."

The Court: How does it get from one of those coils to the other?

The Witness: You mean the coils, figure 1, your Honor?

The Court: Well, the outer coil to the inner one. You trace one of them and they seem to run right around into each other.

The Witness: They do, your Honor, each coil is a square piece of pipe running into a header, running into here bearing numeral B-3.

Now he goes on to say: "That the effect of the air circulation described is to lower the temperature of the fluid within the coils by carrying away a part of the heat with the agitated air.

"Our coil may be used in connection with a steam engine, and the exhaust steam may, from said engine, pass through said coil and thereby condense."

The Court: Does he tell what the coil is made of?

The Witness: He does not.

The Court: Or what size it is?

The Witness: No. Now, I have one more patent which I would like to direct to the attention of the Court as bearing on this subject, a patent to O'Brien, number 1189470, July 4, 1918.

Mr. Frye: Is that patent listed in the answer?

The Witness: I am unable to state without consulting the answer.

Mr. Frye: Well, it is, we desire to inform your Honor. How about it in the file wrapper?

The Witness: It is not mentioned in the file wrapper.

This patent shows another one of the air coolers or humidifiers, such as Leslie's patent, and in figure 1 of this patent is shown an ordinary electric fan, 20. Now, I believe your Honor will take note that that is an ordinary electric fan and we can safely assume that the fan is from 8 to 16 inches in diameter.

I believe there is no commercial electric fan of the type shown in this drawing with blades 18 inches in diameter. In fact, I seriously doubt,—I do not believe there are any fans larger than 16 inches made and sold commercially.

Mr. Cooper: I have seen them three feet in diameter, if you want that.

The Witness: If I may be permitted to reply to counsel, I would ask him where he ever saw an electric fan of the portable type on a base as shown in the drawing, three feet in diamete.

Mr. Cooper: Go ahead, go ahead.

(Resuming.) Now, this fan being of the ordinary type, and assuming that it is of the maximum size, to wit, 16 inches in diameter, your Honor will observe that the coils forming the element there for humidifying or condensing,—he says he puts a pan underneath this coil to catch the water condensed from the coil—must necessarily be about one-quarter to ⅜ of an inch in diameter. You could not physically get that much pipe into a cylinder, 16 inches in maximum diameter, you could not bend any pipe much smaller than ⅜ inch to the radius necessary, nor could you get the requisite number of turns to accomplish anything; so that common sense, without any technical interpretation, shows that the ⅜ inch tube with thin wall is something that is in very common use.

Now, in that patent he states that instead of water as a cooling medium there, a refrigeration system can be used. "I may circulate brine, ammonia, or any other cooling fluid, or steam or any heating fluid, through the coils to effect the desired change of the temperature of the air."

And here your Honor will observe that in dealing with all of these heat transfer devices, that you can very often reverse their function, and instead of making them cooling devices, you can make them heating devices by the simple expedient of putting steam through that coil instead of a refrigerating medium; and that being the case, the whole heating art is filled with examples of small tubes, having thin walls, because that is the natural, obvious, common sense thing to do when you want to transfer heat or cold.

The Court: What is that handle on top of the thing for?

The Witness: To carry it around, I take it, your Honor, that was a very small machine. I have not examined the patent with particular respect to the handle, but I surmise that that is the particular purpose of it,—showing quite clearly that the fan in that structure must be 12 to 16 inches in diameter, rather than three feet, or some other imaginary dimension.

Q. 115. Does that exhaust the list that you were to refer to here?

A. That completes the list in respect to the small tubing.

Q. 116. How about the French patent to

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Fascio, to which you called attention at an earlier hour this afternoon? Does that show what you would consider small tubing?

A. The tubing shown in this patent must of necessity be small, to operate in the manner which he describes. There is a peculiar function that takes place in this coil, in addition to that of condensing, and in order to have this machine operate, the tubing must be of small bore. I should say that the upper limit would be ⅜ of an inch. I know that the only one of them that I ever constructed of this type had to have a tubing of less than ⅜ inch in diameter.

Q. 117. Well now, there has been a lot of mention of SO2 as a refrigerant, a special combination and so forth, that you called attention to in the file wapper. Now, we desire you to tell his Honor, and read into the record any patents that you have found that specifically mention the use of SO2 as a refrigerant prior to the date of filing of the Wolf patent in suit.

I will limit that a little: If you will cite to us three or four, without further specific questioning, it will suffice; but we desire you to call attention as to whether they are in the answer or file wrapper.

A. The patent to Pictet, 187413, of February 13, 1877,—

Mr. Frye: I believe that is in the answer, is it not?

The Witness: I do not think it is in the answer.

Pictet recognized as a pioneer in the art.

A. (continuing). Pictet is recognized as a pioneer in this art.

The Court: Are you saying this particularly on the size and kind of the tubing?

The Witness: The use of SO2.

The Court: It is on the use of SO2.

The Witness: On the use of SO2.

A. (continuing). He states that he has invented "Improvements in processes of producing artificial cold by means of Anhydrous sulfurous acid," which was the term then employed for what is now known as Sulphur Dioxide or SO2. He goes on to describe his refrigeration system, but as this system came into extensive use and I believe the position of Pictet in the at is known fully to all of the engineers present, both of the plaintiff and defendant, I will not go into details with respect to the system.

The next patent is that to Lowe, defendant's exhibit 11.

Q. 118. Which I believe is not in the answer, is that the fact?

A. It is not.

Q. 119. Nor in the file wrapper?

A. It is not.

The Court: What is the date?

The Witness: April 2, 1867.

The Court: And the number?

The Witness: 63413.

Lowe indicates that theory was well known in 1867.

A. (continuing). He starts off by saying that "It is well known to men of science that certain bodies which at ordinary temperatures and at the atmospheric pressure, can exist in the state of gas only, when subjected to sufficient mechanical pressure, they are converted into the liquid state, evolving their latent heat. When these liquids are relieved from this pressure, they return to the state of gas, and in so doing, absorb heat from surrounding objects and render it latent, or in other words, surrounding objects will be cooled thereby. Certain gaseous bodies, such as the atmospheric air, oxygen and hydrogen, do not change their state as above. Carbonic acid, sulfurous acid, nitrous oxide and some hydro carbon gases are examples of bodies which ordinarily exist in the gaseous state and which, by mechanical compression, are converted into liquid state as above stated, and it is such that I employ in my process, preferring, however, carbonic acid."

He specifically mentions sulphurous acid or SO2.

Now, the patent to Audiffren, 898400.

Q. 120. Is that one to which you have referred in connection with the claims of the patent in suit?

A. It is.

Q. 121. And is it in the answer?

A. It is.

Q. 122. And is it in the file wrapper?

A. It is not.

This patent uses sulphur dioxide; and the final patent to which I direct attention is British patent to Knott, 1879,—number 2035.

Q. 123. Is that patent part of the file wrapper?

A. It is.

Mr. Cooper: Not cited in the answer?

Q. 124. Is it cited in the answer?

A. No. I cannot read this photostat. Will you find out for me where SO2 is mentioned? It is not my marked copy.

(Continuing) On page 5, line 26 he states, "The acid which I prefer to use in this apparatus is anhydrous, sulfurous acids, but the apparatus is constructed so as to work with almost any of the well known chemicals or chemical compounds that vaporize readily and can be condensed in the manner described."

Now, your Honor will observe that with the exception of Audiffren, all of those patents on SO2 are back in the very very early days of the industry. Here is Enott in 1879, Pictet in 1877, Lowe in 1867, in this country, and since those times the use of SO2 has been well known, the constance of the gas published many times, and in many books, everything about the subject of SO2 that could be known was known long, many years, prior to the advent of opening this field.

Q. 125. Now, Mr. VanDeventer, there has been a considerable mention in this case of household refrigeration machines. I don't remember whether the question was asked you, of whether you, as a skilled mechanical engineer in refrigerating matters, consider household machines or refrigerating machines for household use, as any different kind of refrigerating apparatus than the so called large machines, or those adapted for commercial use.

Mr. Cooper: If I may interrupt, this is a subject of considerable examination at the very beginning of this testimony yesterday afternoon.

Mr. Frye: If he has answered it, we will withdraw the question. I do not remember, frankly.

Q. 126. Assuming that that question has been answered by you, we will go on to the next: Will you point out briefly some three or four patents of the prior art, showing the use of the disclosure of the patents in households? By that I mean residences, small shops, or what we have termed "Indoor use"?

Whitaker patent outlines purpose to produce a small machine for use in private homes "where it may not receive expert care and attention."

A. I will take three, because they are as good as 300. We have the Whitaker patent—

Q. 127. Is that mentioned in the file wrapper?

A. (Continuing) Number 911635. It is not mentioned in the file wrapper.

Q. 128. Will you please look again at it? I thought it was mentioned in the file wrapper.

Mr. Cooper: Well, let's concede the fact to be, and go on to something else.

A. Whitaker states "The object I have in view is the production of a refrigerating plant which will be simple and thoroughly practicable, and which may be made in small sizes and used in private residences where it may not receive expert care and attention.

Q. 129. What is the date of that patent, did you say?

A. February 9, 1909. The Emerson and Bishop patent, number 962704—

Q. 130. Is that patent mentioned in the file wrapper?

A. It is not.

Q. 131. Yes, it is.

A. Yes, it is.

The inventors show very clearly a household refrigerator, and state, "Our invention relates to refrigeration appliances and has for its object to provide a self-contained refrigerating system suitable to be embodied in a refrigerator for private homes, hotels, and so forth, which is simple in construction, relatively cheap in cost and provides an advantageous arrangement for circulation of air with respect to the cooling medium."

I have one more patent, that to F. C. Brady, number 1037423, dated September 3, 1912.

Q. 132. Is that patent mentioned in the answer?

A. It is. The inventor states "A further object of the present invention is the provision of a refrigerating plant adapted for use in homes, stores and the like, the same being so constructed as to dispense with the use of ice and a mechanical or motor operated refrigeration machine being operably connected to produce a refrigerating effect upon compartments for holding articles to be refrigerated."

I think, your Honor, that with these three patents we can close that part of the testimony relating to household machines. There are many other patents even earlier than these which refer to household machines, but here, prior to Wolf, were men stating merely the purpose of their invention, showing household machines suitable for use in houses, large and small.

Q. 133. Now, there has been considerable mention about air cooling in the trial of this case, and as I remember your testimony yesterday, you said that cooling by air alone, and by air and water, and by water alone were substantially well known things at the time of the filing of the Wolf Patent.

Now, we desire you to schedule for his Honor's attention and on the record three or four patents earlier than the Wolf patent in suit that recite air and water combined for cooling condensers. Can you do that quickly?

A. All of the patents I will now mention are set up in the answer, and two of them, the Audiffren patent 898400 and the Martin and Beath patents reissue, number 4992, have already been discussed.

There is also the Wolf patent, number 1064372.

Mr. Frye: Is that the same or a different Wolf from the patentee of the patent in suit?

Mr. Cooper: I object to that as incompetent. He has no more information than shown in the patent, I suppose.

Mr. Frye: I don't want his Honor to get the idea it is the same is all.

Linus Wolf of Germany used air cooling.

The Witness: The applicant in this patent is Linus Wolf, a subject of the Emperor of Germany residing at Zurich. This patent, may it please your Honor, shows one of the ordinary types of compression refrigerator systems, and has a condenser, and states: "The air cooling process is carried in coil 11, which connects with the pipe 10, and which may be provided with the valves 12, to increase the radiating surface. This coil may be subjected to natural or artificial air currents, and because of the very higher temperature at which the gases are introduced to the coil, the temperature thereof will be materially reduced by radiation from the coil and radiating flanges or rings, 12."

Then he goes on to state that from this coil the compressed gases pass into another coil, 13, which is immersed in a body of water for further cooling of the gases.

Now, nobody can argue whether the air cooling part of that job is the major part or not. He says both air and water cooling. It is just as fair to say he did most of his cooling with air and supplemented it with water, as it is to say he did a little of the cooling with air and took all the rest of the heat out with the water. Nobody can tell.

From the diagrammatic representation in the drawing, figure 1 of the patent, I would say he had considerably more air condenser than he had water condenser, and it would certainly not involve any more invention to make the pipe 10 long enough and put enough fins on it to cool with the air and be done with it.

Rau used a fan.

Now we have one more patent in this group that is British patent number 23894 of 1901 to Rau. This inventor has a coil, C, which is wrapped around a sort of stack or flue, D, and he has a fan, K, and he draws air down in the direction of the arrow J, circulating it about the coil C, pulling it up through openings in the bottom of this stack, and thereby cooling these coils.

There are other things to this Rau patent, but they need not be gone into.

The Court: No water in it at all.

The Witness: Yes, there is water in that.

The Court: Down at the bottom?

The Witness: Down at the bottom. He says that the—

The Court: Which way is the gas passing through these tubes, up or down.

The Witness: In the direction of the arrow, your Honor, over at the right hand side of the figure; it is passing downward I take it.

The Court: It gets the air first and then winds up with the water.

The Witness: Yes, that is my understanding of the drawing.

The Court: Is the idea of the water represented by the dotted line shown at the bottom?

The Witness: I think that is the bottom of the tank, your Honor.

Mr. Cooper: If you read line 31 you will see what it is.

Mr. Frye: Does the witness notice at the bottom of the drawing below the valve C, the markings for water, the conventional markings of the patent office?

The Witness: They begin on line 31 here.

Mr. Cooper: The specification describes it.

The Witness: (Continuing reading) "By means of a flange in which at a certain point of its length contains a water tight partition, E, immediately above which it has several vertical slotted openings F."

I think your Honor will perceive how the water is gotten into the bottom of the condensing column there.

Q. 134. Now as a parallel to the air and water together for cooling condensers, I wish you would call attention of his Honor and put in the record a few patents showing the use of air alone for cooling condensers prior to the filing date of the patent in suit, mentioning at the same time the facts as to whether they are in the answer or file wrapper?

A. The Loew patent, 63413, has already been discussed. The patent to Evans, 328380, in 1886.

Evans emphasizes objections to water cooling in patent dated 1886.

Q. 135. In connection with that Evans patent I would like to have marked for identification the large chart to which the witness may refer in talking about it.

The Witness: The inventor says: "The invention relates to apparatus for refrigerating purposes, and in the practical use of the mechanism of this class one of the serious obstacles encountered is the very large consumption of cold water required for the assumption of heat from the pipes and for the condensation of the steam together with the hot ammoniacal or other gases used in apparatus of this class."

He says, "My invention has for its purpose the substituting for the large volume of cold water heretofore required a continuous artificial current of air under compression or air and water combined in various proportions of temperatures between the normal and freezing points, as fully described heretofore."

He says figure 5 is an elevation of a condenser or cooler illustrating an apparatus in which air and water may be used separately or together, and that is the figure, the enlarged view of which we have here.

He says: "I have substituted for the cold water a current of air which may be more or less reduced in temperature in any suitable manner and may either be in a dry or moist condition. This air may be driven through the pipes under more or less pressure, or if desired may be used in conjunction with a proportional volume of water."

Now I will proceed to explain, and I think I can do it more briefly without reference to the patent, exactly what he does. He has a fan here, or a compressor, and this compressor is conected up to a series of pipes which have within them or around them a series of pipes. Now, he takes the hot refrigerant through one set of pipes and the cold through the other. He says: "The air procured by the fan, 12, may be refrigerated before entering the condenser by driving it over an evaporating surface constantly moistened, or in any other suitable manner, the mechanism may, however, be so constructed as to use air or water separately or both together. When using atmospheric air according to my invention, without the artificial moistening thereof, it is important that the temperature of the air should never fall down to or very close to freezing, so that the air will carry more moisture at a high temperature and thereby remove most heat.

What he has here is a condenser, which has a series of pipes within pipes.

The pipes that carry the air are the larger ones surrounding the smaller pipes.

The Witness: Exactly, your Honor, these pipes colored yellow in the figure are connected together at the alternate ends, and the air is blown in here from the blower by two of them surrounding pipes colored red, which carry the refrigerant. This, as he says, is purely an air cooling system. Now you can introduce moisture in here if you so desire, but he says it can be used either way so that we consider that to be straight air cooled.

Now we have the British patent to Hill.

Hill devised a portable machine with a fan operated by a horse moving in a circular path.

Q. 136. Is this patent mentioned in the answer?

A. Yes. You mean the patent I have just indicated.

Q. 137. The one you are now beginning on?

A. It is not. That is number 17071 of 1888, the Hill patent.

Mr. Frye: We ask to have it marked as exhibit 40 for identification.

Mr. Cooper: It is all subject to our objection, not plead, and no notice has been given.

The Court: It is admitted as showing the shape of the art.

Mr. Cooper: We will have to get copies of this, we have never seen it before.

The Witness: This patent to Hill, your Honor, relates to the refrigerating or ice making machines, and he says an important feature of the invention is the construction of the machine mounted upon wheels in such a manner that it can be very readily transported or moved from place to place, and the mechanism for producing the cold can be driven by the tractive force applied to the machine, and he also states that another feature of the said invention is the provisional means whereby the condensation of the ammoniacal gas or other refrigerating agents may be effected either by means of water or by means of atmospheric air.

In his specification which I have heretofore quoted from, the provisional specification he states that, "Another feature of the invention is the provision of suitable means whereby while the machine is stationery," that is to say, when no tractive force is applied to it, "the means for producing the cold can be driven by a horse or other animal moving in a circular path around the machine. In some instances, however, we provide for operating the said mechanism where the machine is stationary, by manual power or by any other suitable means." He says: "Another feature of our invention is a provision of suitable means whereby the condensation of the ammoniacal gas or other refrigerating agent may be effected by means of either water or atmospheric air." He has an ice box or cooling chamber, D, and at the same time a pump, F, a condenser, E, and the pump he says may be of any suitable construction, and it is obvious that the construction and arrangement of the mechanism may modify or depart from the nature of the invention. For instance: "We sometimes make the condenser so it can be used with either water or air as the cooling medium, or we provide two condensers, one for air with water and the other for air with air; in the latter case we provide a suitable fan or blower to be driven from the driving shaft." And he claims this in the third claim of his patent: "A refrigerator or ice making machine mounted upon wheels in combination with a suitable mechanism whereby motion may be transmitted to its driving shaft from one of the said wheels during transportation, and from another shaft operated by a horse or other power while the machine is stationary, substantially as described."

He says in his first claim, "A refrigerator or ice making machine wherein provision is made for condensing the ammoniacal gas or other refrigerating agent by means of either water or air, substantially as hereinbefore described."

Q. 138. I believe you said this was a British patent?

A. I did.

Coleman made a condensing coil with fins in 1902.

Q. 139. Now, let us go to the next one.

A. We have patent number 708814 to Coleman, which is in the answer, and Coleman shows a storage or condensing coil or chamber, 1. This chamber is equipped with radiating fins, and he goes on to state that the above described members or portions of the refrigerating system, and he is describing the pump or compressor, The expansion coil and the condensing chamber are in a broad sense usual to the present type of refrigerating systems and apparatus, and may be of any usual and approved construction and coupled together in any usual and suitable manner."

I want to put that patent in as showing a condensing coil having fins, and that is in 1902.

That is in the answer.

Now we have another Coleman patent, 1014120.

Q. 140. That is in the answer?

A. That is in the answer, and it has a condenser too, which is shown as a chamber having a radiating rib, or ribs, so that it is adapted for air cooling. Now we have the French patent number 451705 to Burke, which is in the answer.

Q. 141. Is it also in the file wrapper?

A. No.

Q. 142. I think you better examine the file wrapper and ascertain definitely.

A. Yes, it is in the file wrapper. This patent can be very briefly dismissed by pointing out to your Honor that the expansion coil or tank,—and it is a tank in this patent, is identical with the evaporator, upholding my contention that the two are interchangeable. Here is the expansion tank or evaporator inside, noted by numeral 19, cooling the box inside, and identical, the same structure as the evaporator 18 on the outside. Both of them were provided with fins, one for the purpose of taking heat in, and the other for purpose of taking it out. That completes the group of patents relating to air cooling only. That is, with the exception of the French patent 401989 which has already been referred to.

Q. 143. And do you know from your own personal experience as well as from the patents which you have been talking about, that condensers have long been made without tubes?

A. Yes, sir.

Q. 144. And also with tubes?

A. Yes, sir.

Q. 145. And are those tubes of varying diameters according to the capacity of the condenser or the conditions in which it is to be used?

Mr. Cooper: I think that was fully stated by this witness yesterday. He went into it at considerable length.

The Court: He may answer.

The Witness: They are.

Q. 146. Now among the very types of condensers which have come to your experience or have been shown in the prior art, will you give a few examples as to the shapes just by way of example?

A. Well, we have the coil condensers, and their shape is depending on where you want to put the condenser and what type of machine you are going to put it on, and the location of the condenser in relation to the other parts, the kind of refrigerant that you wish to condense, and many other factors; it is merely a matter of design. You give a man the problem of designing an iron beam for a building, and he will get all the factors necessary and then proceed to design the beam accordingly. The number of types of condensers which it is possible to make would run into the hundreds. I personally, I suppose, have seen probably 50 different kinds and sizes and shapes of condensers, both with and without tubes, and with all kinds of fins and cooling surfaces.

Q. 147. Now you have mentioned the coil. How about cylindrical—

A. Yes, tanks of all sizes and descriptions, both with and without fins and with plates inside and plates outside have been used as condensers.

Q. 148. How about spherical?

A. Yes, various spheres have been used, and combinations of spheres.

Q. 149. Now have you, during your experience with refrigerating apparatus either had knowledge through personal contact or through the usual periodicals or publications with which mechanical engineers and refrigerating apparatus are in close touch, known of the various air cooled apparatus that have been put on the market?

A. I have.

Van Deventer had a Domelre machine in his home in 1913.

Q. 150. Have you ever heard of the Domelre apparatus to which mention was made in the prima facia case?

A. I have.

Q. 151. Did you have personal knowledge of the Domelre machine, or the company with which you began, did they own one?

A. I had one in my house for a short time, whether I bought it personally or whether it was bought and paid for by the company I don't know, but it was in my possession.

Q. 152. What year was this if you remember?

A. About 1913, perhaps a little sooner than that, I have been unable to fix the exact date, but to the best of my recollection from the place I was living at the time it was prior to August 1, 1914, the outbreak of the war.

Q. 153. Now will you tell the Court what you remember of the Domelre machine, particularly with regard to the successful operation?

A. I have heard of this machine in some way, and at that time was greatly interested in new small refrigerating apparatus, and I wrote to Chicago—my concern having an office there at that time, and I asked somebody to get me all the information they could about this machine, and I got back word that they had seen Mr. Wolf, who was connected with that enterprise—

Mr. Cooper: I think I will object to this as hearsay, it was not called for by the question.

Q. 154. Never mind the details, just the instance of that without the hearsay.

A. Well, they shipped the machine and I got the machine, and I unpacked it, and we connected it up to an evaporator, a box that I had, and the machine ran for possibly a week, and a defect developed in the cylinder, and it stopped running, and we repaired it and put it into service, and it ran again, but it was very noisy, and we had continuous trouble with it, and after we found out all that we could about its operation and what it was supposed to do, and checked it up, we found out it was not worth anything at all from any standpoint, and we could not learn anything from it, and we threw it in the junk.

Q. 155. Now from the periodicals and other sources of information of mechanical or refrigerating engineers, did you learn that the Domelre machine was sold for a short time and then disappeared from such publications?

Mr. Cooper: I think, if your Honor please, I will object to that as purely hearsay. They can't approve that way.

The Court: Well, let it go in the record.

A. From what I heard the company had—

The Court: Some of it perhaps is difficult for one side to prove, and rather puts the other side, who are able to, in a proper way to make proof of it.

Mr. Cooper: But if your Honor please, he starts out, "From what I heard," and I assume he is going to give a conclusion, and I think it is perfectly objectionable.

Mr. Frye: The question is what he sees in publications concerning these things.

Mr. Cooper: Well, the publications ought to be brought in if they are going to be used, if the Court please, on any point of this sort.

The Court: If it is hearsay and general knowledge.

Mr. Cooper: You see, this Domelre sold out to Isko, and Isko went into bankruptcy, and we bought the assets at the bankrupt sale, so we are not successors in the case at all, nor have we any access to the facts.

The Court: I will let you put it in, but I doubt if I ought to consider it as to that circumstance.

Mr. Frye: It is simply a case of what was generally known to engineers.

The Witness: From all that I heard at the time the Domelre Company only lasted a little while.

Q. 156. How long did you personally hear of the sale of air cooled condensers by the Isko Company, or see, I don't care how you got the information so long as its was first hand information?

A. I never saw but one air cooled Isko job, and the people who had that were busy trying to convert it to a water cooled job.

Q. 157. The question is as to the knowledge of sales, if you have any knowledge?

A. I have no knowledge of the Isko business.

Q. 158. I will ask you to state generally what has been your experience as a refrigerating engineer concerning the competition of air cooled refrigerating machines while you were with one, and I would ask you to state if you know of others that were appearing and disappearing or appearing and staying, or whatever was done, I would like a general enlightenment of the situation, if you can do so, and if not I would be glad to have you say so?

Method of cooling did not determine success or failure of early machines.

A. Well, the question of the appearance and disappearance of the machines from the market is one that you cannot point to to air cooling as the reason for their appearance or disappearance, there are so many factors involved, as I said in my preliminary opening—my preliminary remarks and the practical history of this industry, it is not air cooling that made the electric refrigeration industry, in fact there is a machine on the market today that is water cooled, and it is highly successful.

That has enjoyed a ready sale and regarded as a very good machine.

I have seen many air cooled machines, I would say 15 or 20 in the last ten years that have started out and failed. Some of those machines are just as good as any machine on the market today but they lack financing or they lack sales organization, they lack various practical things to put them over. It was not because of any inherent technical advantage that they possessed or lacked that made them either fail or succeed.

The development of the compressor and the working, the mass production of it was one of the great problems. The question of cooling was, from a mechanical and production standpoint, of secondary importance.

Q. 159. Have you finished your answer?

A. Yes.

Q. 160. I believe you heard the testimony of the witness Carpender this morning, concerning various parts of refrigerating apparatuses, one of which was mentioned as the compressor. Now, I will ask you to point out to his Honor the construction, and as far as possible the size of stroke and bore of the compressor of the defendant in this case.

Cut away compressor exhibited.

In that connection, I ask to have a sample compressor which has been partly cut away marked for identification, exhibit 41.

(Cut-away compressor so marked.)

Mr. Cooper: What part of Carpender's testimony refers to the defendant's compressor?

Mr. Frye: None of that.

Mr. Cooper: Well, why the harangue then, why don't you ask the gentleman the question?

Mr. Frye: We will get to that in just a moment. We want to identify the one here, and make a comparison as to sizes.

The Court: What is this?

Reliable Seal Necessary for Successful Operation of Machine

Mr. Frye: This is the compressor of the defendant.

A. (Resuming) Now, this exhibit number 41, your Honor's, is the defendant's compressor. It does not differ except in details from many of the compressors used in the prior art. It consists, you will observe, of a cylinder, and in the head of the cylinder head is the relief valve, so that when the piston goes upward and the gas is compressed to a certain point, this valve will let it out.

The Court: How many pounds pressure is there?

The Witness: Well, that valve in this particular job may be set, we will say, for a hundred pounds. That is a question that would depend on the refrigerant used.

The Court: And the tension comes from that little spring there?

The Witness: Yes.

The Court: Does it, or somewhere else?

Mr. Frye: Is there a set screw mounting, too.

The Witness: Above it?

Mr. Frye: Providing the valve with sufficient tension.

The Witness: Oh yes, it has some arrangement here for adjusting the pressure on the valve to whatever you want. Now, the intake here is taken into the crank case from the side here, and all of this is closed up, and that comes through the piston. The other valve comes in through the piston, down in here.

The Court: When it comes down, the gas comes in through here?

The Witness: That is right, and then it compresses it the same as it does in an automobile exactly.

The Court: What holds that?

The Witness: This valve only works one way, it only works one way, just the same as the top valve works one way.

The Court: Because if it starts up, it presses so firmly down on to the bottom, that no gas can get in.

The Witness: That is right.

The Court: As quick as it starts up,

The Witness: Yes. It was the mass production of these compressors in large quantities at a low price, low cost, that was one of the serious obstacles to the development of the small refrigerating machine. When I say "Small" I mean one which has a cylinder bore either of 1¾ and a stroke of about the same.

Q. 161. What is the bore of the compressor before you?

A. Without measuring it, I would say it was 1½ inch.

Q. 162. And what is the stroke?

A. One and one quarter inch.

Lack of a satisfactory seal was one of the big problems of manufacturers.

One of the main difficulties, your Honor, was to seal this shaft off here. You see, this chamber gets full of gas, and the gas can leak around this shaft, and come right on out into the atmosphere. In other words, the pressure in here may be 60, 80, a hundred pounds, depending on the temperature; so they put in here what they call a seal, and it is a means whereby an element which is held stationary on this member, the fixed member, rubs on a hardened surface attached to the movable member.

You are doubtless familiar with the ordinary stuffing box as used in a pump. Well, when they first began to make these machines they had stuffing boxes, and then later on they devised various types of seals.

The Court: They would leak, I suppose.

The Witness: They all leaked. They all do leak. There is no perfect seal at the present time. They all leak to some extent, but instead of having 50 per cent of them leak, which was the case when they started off, or even more, within a period of say 90 days they finally got the number, the percentage of leaks, down to very small degree, where it becomes a business and not a liability; and that condition did not obtain until they developed these metal to metalseals and did away with the stuffing boxes. The loss in the stuffing boxes was tremendous, because they had a shaft in there which was packed full of packing, and if it had to stand 90 pounds pressure in here, you had to screw up on your gland nut, and the little electric motor out here could not do the work. You would have to have a motor—30 per cent of the power would be taken up in the stuffing box.

Now these seals have some friction, but it is very little; and it was that, and the development of a noiseless valve, the construction of a piston here which could be ground—and many of them were even honed—the application of the principles of automobile mass production to the production of these is the thing that made it a business, not any one particular invention, or not any one particular principle, such as air cooling. It was the overcoming of a number of obstacles, most of which were overcome when big people with lots of money began to come into the business, and they could spend the money to overcome them.

While we are talking about compressors, your Honor, I would observe that here is the place where the pipes connect to it.

The Court: That is the most difficult thing about the whole outfit, isn't it, is the compresser?

Motor troubles and leaks in stuffing boxes and in castings caused much grief.

The Witness: That is the heart and soul of the machine from the standpoint of mechanical wear and tear, the thing that is liable to wear out, the moving element which causes trouble. There is not anything else in the ice machines that moves except the expansion valve. The rest of it is all centered here, and in the electrical and the fight was for years to be able to produce these things cheap, and at the same time put them out and forget them.

The Court: I suppose your service comes very largely—or does it, I will put it that way—very largely to the compressor and the motor?

The Witness: That is my experience. I am not qualified to speak on that as well as Mr. Hayes because he has actually manufactured and sold large quantities of these things and paid for the service incident thereto; but from an engineering standpoint, it was stuffing box trouble, and motor trouble due to hot compressors and troubles of that sort, which caused the expense—that and leaky castings. It took them a long time to find out how to make these castings that would actually handle the gas properly. Even the smallest leak is fatal on an ice machine.

It is well known by all engineers working in this business that to get a tight casting, especially in the early days of the industry was a difficult thing, and every company who went into the business on these small compressors had that trouble and rejects in many cases were exceedingly high.

Q. 163. I think one more question to ask Mr. Van DeVenter, among the things that we intended to ask on refrigerants that were shown by prior patents, was a direct reference to methyl chloride, which you have stated is the refrigerant used in the defendant's machine.

I call your attention to the British patent, number 18856 of 1908, issued to ——— Society something or other, I think I will let him copy it rather than pronounce it.

The question we desire you to answer in connection with this, is if it specifically mentions the use of methyl chloride as a refrigerant, and if so, to quote into the record one of two passages where it is mentioned.

Mr. Cooper: That is neither pleaded, nor has any notice of it been given to us until this moment.

Q. 164. Please answer this question: Is that mentioned in the answer?

A. No.

Q. 165. Nor in the file wrapper?

A. No. The inventors say, on line 9 of the patent, "We employ methyl chloride as the refrigerating agent."

Mr. Frye: I asked to have it marked for identification.

Mr. Cooper: Well, that is all subject to my objection.

The Court: It is marked "Exhibit 42" and admitted as bearing on the state of the art only.

Mr. Frye: Take the witness.

(Recess.)

Cross Examination

By Mr. Cooper:

Q. 168. It is true, is it not, that you cannot condense carbon dioxide when its temperature is above 88 degrees Fahrenheit, no matter what pressure you apply?

A. I can only state from my own experience that you cannot condense it with any pressure that can be reached by ordinary means, such as 2,000, 3,000 pounds to the square inch.

Q. 167. So that we can take it as an accepted fact, so far as refrigeration is concerned, within all of your experience and knowledge, that it cannot be condensed when its temperature is above 88 degrees Fahrenheit?

A. You can make that 76 degrees, I think it is in the later tables, Mr. Cooper.

Q. 168. And still have my statement hold?

A. That is right; that has been my experience.

Q. 169. Now, in order to condense ammonia, at say 80 degrees Fahrenheit, you have to compress it to a substantially higher degree than you do methyl chloride or sulphur dioxide, don't you?

A. At what temperature?

Q. 170. Well, let's take 80?

A. I will consult a standard gas table and tell you from that.

Q. 171. Well, I have what seems to be the standard gas table, and it gives 155 pounds absolute pressure for the condensing of ammonia at 80 degrees Fahrenheit, it gives 85 pounds absolute for methyl chloride, and it gives 80 pounds absolute for sulphur dioxide. Does that sound reasonable?

A. I believe you are quoting correctly from the standard gas tables.

The Court: What is this 315 degrees for sulphur dioxide? I wonder if any of you can tell me that? What is that?

Critical temperature of a gas is the point at which it will no longer condense under pressure.

The Witness: Critical temperature of the gas, your Honor, at which temperature point it will no longer condense under compression.

Q. 172. That is, no matter what pressure you put on it, at 315 degrees Fahrenheit you cannot condense it.

The Court: Now, this other, you say 85 degrees, is what? That you cannot do what with it, above 85?

Mr. Cooper: No, I did not say you could not. What I asked there was this: With sulphur dioxide for example—

The Court: That is that same thing?

Mr. Cooper: No, with sulphur dioxide, if you are going to condense it at 80 degrees Fahrenheit, you have to compress it to 60 pounds per square inch.

The Court: You mean, to condense it to a liquid?

Mr. Cooper: To condense it to a liquid. Whereas, you have to compress ammonia to 155 pounds pressure to condense it at 80 degrees Fahrenheit. That means, does it not, that greater power is required for the condensing of the ammonia under the condition given than for the condensing of the sulphur dioxide.

A. Your question is not intelligible. I do not understand it. It depends on how much of it you are going to compress.

Q. 173. Equal amounts, of course, through an equal sized pipe.

A. Equal amounts of what—gas?

Q. 174. Yes. I am asking you about the condensation of gas into liquid.

A. Yes.

The Court: Let me interrupt you right there, let me see if I understand that: You have to cool your carbon dioxide or sulphur dioxide to 80 degrees if you want to condense to a 60-pound pressure?

Mr. Cooper: That is it.

The Court: I have got it then.

Q. 175. Is it not the case that there is a greater tendency to leak with the ammonia compressor under the conditions I have given, because of the greater pressure required, than there is for sulphur dioxide or methyl chloride?

A. What do you mean, leak in the compressor? You mean past the piston or out through the walls of the compressor, or through the valves, or what? What do you mean by leak?

Q. 176. Under the conditions which you so graphically described when you were considering this compressor here before us, which you said was the same as defendant's compressor?

A. That is not an ammonia compressor.

Q. 177. Don't you understand what I am asking you?

A. You are asking me if the compressor has a tendency to leak using ammonia and sulphur dioxide, and if the compressor will leak more with ammonia than it will with sulphur dioxide.

Q. 178. Yes, because of the greater compression required to condense it.

A. What do you mean by leak?

Q. 179. Don't you understand what a leak is?

A. Not unless you define where the leak is going to take place. Is it through the cylinder walls or out through the piston, or around the stuffing or seal, or at the valves? What is going to leak?

Q. 180. Do you not understand that you are a witness, or are you counsel?

A. I am a witness.

Q. 181. Well, all right: Will you answer the questions, or say that you do not understand them?

A. I do not understand the question.

Q. 182. Very well. Do you know how many of the patents of the prior art which you have discussed were not cited in the answer?

A. I do not, without counting them.

Q. 183. Do you know how many prior patents are cited in the answer and the amendments to the answer?

A. I do not.

Q. 184. Did you examine them all?

A. I did not.

Q. 185. How many patents did you examine in connection with the preparation of your testimony, or for your testimony, in this case?

A. Perhaps 200.

Q. 186. Those which you picked out were the best of the 200?

A. Naturally.

Q. 187. And of those that you picked out, you discussed Palmer, 716091; Martin and Beath, Reissue, 4992; Leslie, 439036; Johnson 328784; Audiffren, 898400, as completely anticipating the—some or all of the claims in issue?

A. I did.

Q. 188 Do you regard those last named as the best of the prior art which you searched for and found among the 200 prior patents which you examined?

A. These patents I consider to anticipate in all or part the claims of the Wolf patent in suit.

Q. 189 Now, I will read my question and ask you to answer it.

A. Yes.

The Court: I am not sure that the witness understands the question that he answers "Yes."

The Witness: He was going to repeat the former question, did I take these patents to be the best out of the lot?

The Court: Yes, that is right.

The Witness: And the answer was "Yes."

Q. 190 You speak in the early part of what you call the opening of the beginning of your expert engineering work with refrigerating apparatus as about the year 1906. With what concern were you connected at that time?

A. Sumpter Telephone Manufacturing Company.

Q. 191 That is at Sumpter, North Carolina?

A. Yes.

Q. 192 And you continued with that concern continuously until 1914 or 1915?

A. Some time later than that, it and its successor, its corporate successor; it changed its name at one time from the Sumpter Telephone Manufacturing Company to the Sumpter Electrical Company.

Q. 193 What is the name, if you know, of the household type of refrigerator which it got out?

A. It never got out any.

Q. 194 You stated that you began again after the war in that type of work with the Westinghouse Electric & Manufacturing Company. You were located then at Philadelphia?

A. East Pittsburgh, Pennsylvania.

Q. 195 And you worked with it for three years on the study of household refrigeration?

A. Largely on that matter, but was engaged in many other matters.

Q. 196 What is the name of the household refrigerator they have on the market?

A. I don't know.

Q. 197 Has it one?

A. I don't know.

Q. 198 You never have seen it?

A. I have not.

Q. 199 During those periods of work in connection with refrigerating apparatus and applications and so on did you solicit patents on improvements in the household type of refrigerator?

A. Only from my immediate associates.

Q. 200 I say did you do such soliciting work?

A. Yes.

Q. 201 You testified as I understood you that you have been instrumental in building a refrigerating machine. In just what way?

A. As an engineer, assisting the manufacturerers to get quantity production, to develop tools and find the proper materials and assemble them into complete electric refrigerators.

Q. 202 With what company?

A. Domestic Electric Refrigeration Corporation of New York is one.

Q. 203 Has it a household refrigerator out now?

A. Yes.

Q. 204 When did it come out.

A. 1927, I believe.

Q. 205 Was it based on a patent which you solicited in whole or in part?

A. No.

Q. 206 It has no patent?

A. No, not yet.

Q. 207 Has it applications covering asserted inventions in household refrigerators which you solicited?

A. Many.

Q. 208 You heard, I believe, Mr. Carpender testify this morning, did you?

A. I didn't pay much attention to Carpender's testimony, I was engaged in arranging my work, and a great deal of his testimony escaped me.

Q. 209 Did you hear him testify about the small sized ammonia compressors which his company used in these household machines?

A. I believe I heard him say that he used an ammonia compressor with an inch and a quarter or inch and a half piston bore.

Q. 210 Are you familiar with the Brunswick refrigerator that company put out?

A. Not particularly.

Q. 211 Do you know whether it leaks more or less than the compressor of the defendant?

A. I am unable to answer that question.

Sumpter Electrical Co. experimented on small refrigerating machines.

Q. 212 How large were the ice machines that the Sumpter Company put out?

A. They never put out any ice machines.

Q. 213 What did they do about refrigerating? Is there any mystery about it?

A. No, thy didn't do anything at all. Mr. Charles T. Mason, who was president of that company, and myself and associates, experimented for several years on the development of the small ice machines. We made many different forms of compressors, both single cylinder type, the sylphan type, rotary types of various and sundry kinds, in fact we carried on a general experimental program for a long period of time to try to find the commercial ice machine.

Q. 214 And did you make applications for patents on asserted inventions of your own in that connection?

A. No, I did not make any inventions?

Q. 215 None by you?

A. Nothing that we thought worthy of patents. We were trying to get something that was commercially practicable and could be manufactured and sold at a price that would reach the market.

Q. 216 Now you have said, as I take it, that you never saw any other patent in relation to refrigeration apparatus except the Wolf, and one which you later gave in your examination, in which the dimensions appear, the dimensions being that part of the specification of the Wolf patent which begins at line 96 of page 1 and describes the length of the tubing of a certain cross section and so on, which I will not repeat.

A. May I ask that my answer, my former answer be read to me. The question that Mr. Cooper says I answered. I want my answer read to me.

Q. 217 The question was: "Whether that statement of dimensions was in your opinion an unusual one, or was it a customary one in patents," and the answer, "Not in this art. It is an unusual thing in this art, because it is a repetition of a perfectly obvious thing long known and described and used prior to this specification." Do you know now what I am talking about?

A. Yes.

Q. 218 Now testifying as a lawyer, or patent solicitor, or whatever capacity you may be testifying in here, do you assert that there is any impropriety in a patentee stating that?

A. No, not at all, I said it was unusual, not improper.

Q. 219 Now as a patent solicitor you are quite familiar with the law of patents, are you not?

A. Fairly so.

Q. And you are familiar with the statute known as Revised Statute, Section 4888, which requires that the inventor, "before he shall receive a patent, shall file in the Patent Office a written description of the same, and of the manner and process of making, constructing and compounding it, in such full, clear, concise and exact terms as to enable any person skilled in the art or science to which it appertains"—you are familiar with that?

A. I believe you are quoting correctly from the statute. I am generally familiar with it.

Q. Do you know at the present time of any air cooled household refrigerator which uses ammonia as a refrigerating agent?

A. Oh, I think there are two or three of them. I saw one about a month ago.

Q. Well, tell me which?

A. I could not tell you that, Mr. Cooper, without I get down to my office and get the file.

Q. You are quite sure you have seen an air cooled household ammonia refrigerating apparatus?

A. Yes.

Q. And you cannot recall the name?

A. No. I see something like that every month, Mr. Cooper, all kinds and sizes and descriptions. There is one born every thirty days or less.

Q. Well, I thought it was Mr. Barnum who made the remark that you have half quoted, but he referred to it as there being one born every minute, didn't he?

A. I don't know whether he was referring to the refrigerators or not, but that certainly applies to a good many people who have been in the business in the past and probably will apply to many more who will go into it in the future.

Q. Well, that is the one thing I have heard that sounds to me like common sense from your lips during this examination. Have you any knowledge of the average size of such freight cars as are commonly used and have been for many years as conveyors of perishable goods, and commonly designated "refrigerator" cars?

A. I have no special knowledge of such cars.

Q. Would you take 8x7x32 as being a probable interior dimension?

A. It might be.

Q. Are you prepared to dispute that that is the ordinary size?

A. I am not prepared to dispute it. I don't know anything about freight cars.

Q. Never looked at one?

A. Yes, many times, but not with a view to determining the cubic content of it.

Q. I did not ask you for the cubic content. I suppose you recognized that. I asked you for the dimensions.

A. I don't know the dimensions of a freight car.

Q. All right. You produced a large drawing in connection with the Palmer Patent. Do you prepare that yourself?

A. I did not.

Q. Did you compare it closely with the Palmer drawing? I am referring to the Palmer patent, 716091.

A. I did in respect to the particular parts about which I was to testify.

Q. You did not observe any important variation from the drawing?

A. I did not.

Q. Let us turn our attention for a moment to that. It has no exhibit number on it.

(Counsel and the witness go to the chart referred to.)

Q. Look at figure 1 and figure 2 of this drawing, and tell me where the air intake for the fan is.

A. I don't know.

Q. Well, now, assuming that the drawing of the patent shows it about the position where I put a cross or mark here, which I will indicate by an "X", there the air inlet would be at the top of the blades, wouldn't it?

A. Yes.

Q. Where would the air outlet be?

A. That would be on the other side of the fan.

Q. Wouldn't it have to go up this passage?

A. It would go up through the condenser.

Q. Can a fan of that sort operate by taking a periphal outlet?

A. It will if the outlet is bigger than the intake.

Q. It will?

A. Yes.

Q. Now, this compartment marked B is a closed compartment, as shown on the drawing, is it not?

A. I think it opens to the outer air.

Q. Where, as shown on the drawing?

A. I will have to look in the patent to find out.

Q. It is not shown in the drawing, is it?

A. No.

Q. And there is no outlet from that fan that would afford a circulation of air by the fan as shown in the drawing?

A. The patent describes it. You have got to turn to the specification to find out what the drawing means and vice versa. That is also in the statutes.

Q. That is a pretty smart answer—wasn't it? Now, just read from the specification that part which you say describes where the outlet is from the compartment marked B?

Mr. Frye: Your Honor—Mr. Cooper—if you don't object, these drawings were made under my supervision, and I would like to ask permission to show that. It is an error on my part, and I am perfectly willing to admit it. The way it is now, it is quite evident that the fan could not turn without hitting the part there, and the drawing itself, in the patent, clearly shows an aperture intended to make this in accordance with the drawings; and accidentally, the draftsman has put in some section lines. We would like to have it conform exactly with the patent drawings, if that is permissible.

Mr. Cooper: Well, the two lines I have put on will do for indicating at present.

Mr. Frye: At present it will, but what I meant was to make it absolutely in accordance.

Mr. Cooper: Hadn't it better be allowed to stand, in view of the examination which has been given the witness? Otherwise, that will not be understandable.

The Court: I think if you will leave it as it is, with the marks on there, it will show the corrections made, and then the examination will be understandable, and Mr. Frye's explanation of how it occurred may go into the record, too, to explain.

Mr. Cooper: I will let the witness find that out for himself.

The Witness: This is the outlet here (indicating).

Q. No, no, that is not what I asked you. I asked you to read from the specification. You said it was in the specification. I asked you to read from the specification.

A. It don't say it at all, it does not say anything about the outlet except branch pipe K which comes into this chamber here. This ventilator here is connected with this.

Q. K is not as big as the inlet, is it?

A. (K) is here—

Q. I say (K) is not as big as the inlet, is it? Wherever it is, it is not as big as the inlet, is it?

A. It says it is a small pipe.

Q. Then unless you have some other outlet, which is not described, then, according to your own statement that won't work?

A. Why, certainly not. It is so obvious that it does work, that there is no question about it.

Q. What operates that fan, if you are so smart? What operates that fan when a railroad car is stalled on a siding?

A. Nothing.

Q. And the whole apparatus has to be idle as long as the car is on the siding, does it?

A. Yes.

Q. What is the velocity of the vapor in the ordinary operation of the defendant's apparatus?

A. I don't know.

Q. Why don't you know?

A. Because I never tested it.

Q. What is the velocity of the vapor in the plaintiff's apparatus?

A. I don't know.

Q. Does the velocity of the vapor have anything to do, according to your theory, with refrigeration?

A. Yes.

Q. Does it have anything do to with the operation of cooling the condenser?

A. Yes.

Q. Look at Martin and Beath patent 4992, re-issue patent of July 16, 1872, and tell me me what you think is the means there shown for rotating the spindle or pipe (c).

A. He does not show any.

Q. What do you understand to be the diagonally rising lines, or outwardly curving lines from the member marked (I)? Look at figure 2.

A. They may be supports for the condenser coils, or they may be portions of the coils themselves.

Q. Well, can not you see that they are portions of the separate lengths of coil. Take the one going out furthest to the left, don't you see that it goes up to the left end of what appears to be a downwardly slanted coil?

A. That is the way it looks to me.

Q. What hapens at the other end of that particular coil? Just follow it up. Where does the other end of that go?

A. It starts into the header connected to the pump.

Q. That is, the header (1)?

A. I can not see in my copy, Mr. Cooper.

Q. Oh, I beg your pardon. I just wanted to identify it.

A. Maybe your copy is better than mine. The pipe of the condenser seemed to start at a vertical riser on the left of the chamber (L), and proceed towards the right in the figure sloping downward, and then are bent to enter the receptacle (1).

Q. Well now, just start from the other end up: start from that receptacle (1) and take the left hand outwardly flaring pair of lines, and it seems to me to reach up to and to be merged in the left hand end of the fourth coil from the bottom. Is that correct?

A. Perhaps if you will show me, Mr. Cooper, it will save time. It is a hard figure to follow.

Q. Now, I am showing you a pair of lines rising from the furthest left position on the bottom member (1) and flaring upwardly to the left, and they seem to merge into and become a part of the fourth tube from the bottom; is that correct?

A. Yes.

Q. Now, follow that fourth tube from the bottom, from left to right, and you will see another like pair of lines curving downwardly back towards the member (I) again. Do you see that?

A. That is right, I say.

Q. Then that is a single coil, is it not, connected at both ends to the bottom member (I)?

Q. And you will find similar connections upward from the third coil from the bottom, left and right, won't you—I mean from the third tube, left and right, there and there (indicating).

A. I see the lines that you refer to.

Q. And from the bottom tube at the right hand end, there seems to be a connection back to the member (I)?

A. It seems to run behind it; to me. It probably does go into it.

Q. And if you take that bottom tube, if it be a tube, and carry along from right to left, you find that its left hand end goes into the header, vertical header (H).

Q. Look for a moment at the Johnson patent, 328784. Can you, according to the

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idea of the freight car that is backed up to the station at Figure 1, get any idea of the size of the structure of the right hand part of that figure, which structure is where the refrigerating apparatus is?

A. I can not, because this Figure 1 is purely diagrammatic, and the car is drawn all out of proportion to the rest of the figure.

Q. Now I will read to you what the specification says on that point: "Figure 1 represents a sectional elevation of a cold storage warehouse, and one car with my improvement applied." Where does it show it is diagrammatic?

A. It is perfectly obvious it is diagrammatic, because the car wheels here, which are not ordinarly over twelve inches in diameter, are bigger than the entire compressor, and the brick walls are shown as one brick horizontal, placing two bricks on end, and the pipes running into the car are nearly as thick as half a brick.

Q. You say the brick wall is how thick?

A. It is shown here as two bricks on end and one on end sidewise. You are looking at the end of two bricks in each row and the side of one brick.

Q. I do not seem to see that at all. Just to the left of Figure 7 I see two bricks lengthwise, and above that, in regular course, one brick lengthwise and the two half bricks. Well, that is the same thing as two on end and one sidewise; we are talking about the same thing.

The Court: 16 inches anyway.

Mr. Cooper: Yes.

The Witness: Now, if that wall is 16 inches thick, then the car wheels are 16 inches in diameter, and they are not.

Q. How do you know? Can you give the dimensions of car wheels, when you could not give the dimensions of cars?

A. I can not.

Q. Are you prepared to say that car wheels are not 16 inches in diameter?

A. I am not.

Q. Do you mean to say that as a matter of observation that the diameter of the car wheels as shown is Figue 1 is not greater than the thickness of that wheel?

A. I am not.

Q. Where did these copies of patents come from which were produced today for the first time?

A. I don't know.

Q. When did you get hold of them?

A. When?

Q. When?

A. Saw them last night.

Q. Where did they come from?

A. I don't know.

Q. Did they comé in the mails, or has counsel been sitting on them and keeping them away from us?

A. I don't know.

Q. Are you an attorney at law?

A. I am not.

Q. Where did you pick up the phrases like "my opening" and "your honor will take judicial notice," and some phrases like that that you have used so frequently?

Mr. Frye: I object to that; what difference does it make.

The Court: I will sustain the objection.

Q. Do you know where ether refrigerant is used commercially now?

A. No.

Q. You don't know anywhere in the world where it is used?

A. No.

Q. Did you ever see a rotating refrigerator on an automobile?

A. Yes.

Q. Where? What make?

A. I can't tell you.

Q. It's another of the things you have forgotten?

A. It's so many years ago that I don't recollect it. It made no impression on my mind at the time.

Q. Have you examined critically any of these other enlarged and colored drawings, purporting to represent some of the parts of the drawings of some of these patents to which you have referred, so you can say that they are accurate enlargement drawings which they purport to represent?

A. Yes.

Q. You say that they are all accurate in every detail?

A. Well, they are reasonably accurate as drawings of that kind can be. They are made by a draftsman, and there is naturally some differences in scale and the configuration of the various parts.

Mr. Frye: The witness has said he had nothing to do with the makings of these drawings, and I stand responsible for anything that is out of order in them, and am perfectly willing to accept the responsibility.

Mr. Cooper: I am quite entitled to ask the witness, it seems to me.

Mr. Frye: Well, he has examined them, but I do not think he is prepared to swear to anything further. He examined them while here in Bay City, if you want to show further.

Mr. Cooper: Well, have you done?

Mr. Frye: Well, there is an objection against the question.

The Court: Well, he may answer to the extent to which he has examined them.

The Witness: I examined these drawings as provided by counsel and determined that they were reasonably accurate in order to present to the Court the information that we desired to present. There may be details in these drawings which are not germane to the matters in suit, which are improperly shown or inaccurate, that I don't know, but the parts of these drawings which represent the matters in suit are as accurate as enlargements of that kind made from patent drawings can be.

Q. Well, what does the red represent in Martin and Beath, for example, this enlarged drawing marked for identification, exhibit 29?

A. The condenser.

Q. That means the high side or low side of compression.

A. That is part of the high side.

Q. So the red is part of the high side?

A. That is right.

Q. Now coming over here and taking a look at it, I will hold my pencil against one of the pair of curved members, marked "P", is that part of the high side of the condenser?

A. It is part of the cooling mechanism.

Q. Is it part of the cooling mechanism?

A. The small pipe, B, out of which water issues.

Q. And that is under high compression then?

A. No, under no compression at all.

Q. Do you remember the Hill British patent, 17071 of 1888 about which you testified?

Mr. Frye: Here it is.

(Paper handed to the witness.)

Q. When was the last time that you saw a horse driven refrigerating apparatus?

A. I never saw one.

Q. That is another scheme where the refrigerating ice machine is driven from the wheels of the vehicle, isn't it?

A. Yes, but independently thereof when the vehicle is at rest, by means of motive power applied to the apparatus.

The Court: That idea is like the old fashioned horsepower threshing machine.

Mr. Frye: Yes, I think it is, your Honor, it was one you could drive a horse round and round.

The Court: I have driven lots of these.

Q. Look at the French patent to Burke, number 451705, and tell me whether you have ever built and operated a machine like that shown in the drawings?

A. I haven't the specification of this patent.

Q. I ask you whether you ever operated a machine like that shown in the drawing?

A. I can't determine from the drawings whether this machine is ethyl chloride, methyl chloride, sulphur dioxide, or what, but if you refer to a machine in which the parts 18 and 19 correspond exactly with each other, that is to say, the evaporator and the condenser correspond exactly with each other, my answer is yes.

Q. Well, I have asked my question. I will have it read to you.

(Question read by the reporter.)

A. I cannot determine from the drawings what the refrigerant is, and I haven't the specification of this patent.

Q. Well, let me assume it is sulphur dioxide?

A. No, but I have used other refrigerants.

Q. What one have you used with a machine identical with the drawings of this Burke patent?

A. The compressor and other parts of the refrigerating apparatus must be adapted to the refrigerant.

Q. Is that the best answer you can give to my question?

A. Yes, as I understand it.

Q. Now, in connection with the Burke patent, you said something to the effect that it is a showing of an expansion tank identical with the evaporator, upholds your contention that they are identical. What do you mean by your contention; are you contending for something here?

A. No.

Q. Well, why did you say that, upholding your contention?

A. I am contending in my discussion of the prior art that evaporators and condensers are interchangeable and practically of the same construction.

Q. You are not contending that they must be, are you?

A. No.

Q. Are you contending that they may or may not be, according to choice?

A. Yes.

Q. Why do you make any contention in the case, what have you anything to contend about here?

A. Nothing.

Q. Has your company any interest in the outcome of this case?

A. None.

Q. Did you volunteer to come and make a contention, or were you sent to come and make a contention?

A. Neither.

Q. Neither?

A. No.

Q. Were you requested to come and make a contention?

A. I was paid to come.

Mr. Frye: I object to this playing of words, I think everybody understands the witness used the wrong word when he said "Contention." He has testified as a witness, and I think everybody knows it. But as a question of meaning I think it should be phrased as, "What do you mean by the word 'Contention' or 'Contending'."

Mr. Cooper: If that was the only time it had been used I would not have done what you say, as playing on words.

Mr. Frye: I don't think it is necessary to repeat it even.

Mr. Cooper: I don't either, but the witness repeated it so often in the direct examination I wanted to find out the significance of it.

The Court: Is there any question pending now?

Mr. Cooper: None that I know of. Counsel is berating me for something.

Q. You have spoken of various refrigerating apparatuses that you have encountered on the market. Have you had access to this journal known as "Ice and Refrigeration" many extracts from which have been offered here by your counsel?

A. I have looked at them from time to time.

Q. Do you recall having seen advertisements of Isco?

A. Yes.

Q. Over what period?

A. I don't recall, up to the time they went bankrupt, I guess, they advertised.

Q. And you were speaking of the necessity of having mass production such as a mass production of automobiles. That, I infer means that a great deal of capital was required in these things?

A. Yes, sir, in my opinion a great deal of capital was necessary.

Q. Did you know, for example, how much capital the Brunswick Refrigerating Company had?

A. No sir.

Q. Did you know that the people who were behind that were the Johnson & Johnson people that have the enormous surgical business there at New Brunswick?

A. No sir, I know nothing about the Brunswick Company and its affairs.

Q. You heard Mr. Carpender testify that their output of household refrigerators was of the order of a hundred a year, did you?

A. Yes.

Q. Is that what you would call mass production?

A. No sir.

Q. Did you ever examine the Brunswick refrigerator of the small house size to ascertain whether it had a serviceable compressor or not?

A. I examined one about 1912 or 1913, and I found it to be a xery excellent machine.

Q. I asked you particularly about the serviceability of the compressor.

A. Yes sir, it made a very good compressor, one of the best on the market.

Q. Of about what bore?

A. I think that machine was about two and a quarter inches, or two inches.

Q. Did you know at that time that they were making them of about 1¼ or 1½?

A. No sir. I did not.

Q. When did you first see the British patent, 18858 of 1908, which you referred to, I believe only for the purpose of quoting from the patents beginning at line 9 where it says, "That employed methyl chloride"?

A. Last night.

Mr. Cooper: That is all.

Redirect Examination

By Mr. Frye:

Q. Do you believe that a coil constructed as in Martin and Beath is an operative coil?

Mr. Cooper: I object to that as I understood the witness could not describe just what the coil was.

Mr. Frye: On the contrary I thought he described it very well, certain pipes mounted from a header extending around—

The Court: The objection will be overruled.

(Question read by the reporter.)

The Witness: Yes.

Mr. Frye: That is all.

Re-Cross-Examination

By Mr. Cooper:

Q. Now what is the action of (I), what does it connect with?

A. He says that the condenser is composed of a series of pipes, C, connected with the eduction pipe, a descending spiral as they approach the center, and then terminating in the hollow cast iron cylindrical ring, 1, which forms a receiver for the condensed liquid. Now this receiver, as everybody knows, must connect to the evaporator or low side.

Q. Well, where is that connection as shown in the drawing?

A. I don't think it is shown at all in the drawing.

Q. Well, which part of this downwardly and obliquely extended coil members connect with the riser H, in what we call chamber I?

A. The showing in the patent is almost identical with one on the large drawing here, and there is one pipe here that is shown in this, if this is a section. And I take it to be a section, because the ends of these pipes are shown in section.

The Court: Then the second pipe and the fourth pipe are sections of a coil.

The Witness: Now, cut off the way they are, they are suspended here in mid air and don't connect to anything but exact shapes of the loops are convolutions of this condenser cannot be obtained from a sectional view of this condenser.

Q. I am asking you for your understanding?

A. My understanding is that this is an ordinary coil of ordinary pipe, there may be two or there may be three loops in it.

Q. Now will you please answer the question. Take the top pipe that comes obliquely down from left to right, marked in red of that large drawing at its left hand end, disconnected with the riser H as shown there, isn't it your opinion at the right hand end that it is sectioned off so you regard that as looped over and coming around to the second from the top?

A. Yes.

Q. Then follow down the second one, and where does it go from the right hand end?

A. It may go down to the left hand end of the fourth pipe.

Q. But that you cannot tell?

A. You cannot tell that.

Q. Well, then, take the third from the top and follow it down the header at the left to the right hand end and it connects with something, doesn't it?

A. Yes.

Q. Where does it connect?

A. I don't know. Possibly it went into one of those oblique pipes on this side, the side that is cut away, the pipe similar to the oblique pipe on the left hand side of the drawing; in other words, any dead end here which will not connect up with something is the other half of the ring, I, is cut off into sections.

Q. Now you have given the best explanation you can of that drawing?

A. Yes, sir.

Mr. Cooper: All right.

Redirect Examination

By Mr. Frye:

Q. Regardless of the showing in the drawing of the Martin and Beath patent, would it be possible for you, as a mechanical engineer, to build an apparatus condenser from the quotation you have made from the bottom of page 2 of the specification, to-wit:

"Our condenser is composed of a series of pipes, G. connected with the eduction pipe, H, and descending spirally as they approach the center, and then terminate in the hollow cast iron cylindrical ring, I, which forms a receiver for the condensed liquid."

Mr. Cooper: I object to that question as incompetent, it is not what one would do today, but what you would have learned in 1872 from the patent.

The Court: I will sustain the objection.

Mr. Frye: That is all.

(Whereupon an adjournment was taken to Friday, March 23, 1929, at 9:00 o'clock A. M.)

C. C. Palmer, Refrigeration Pioneer, tells of developments in the early days.

Friday, March 22, 1929.
9:00 o'clock A. M.

Court convened pursuant to adjournment.

Mr. Frye: In the excitement at the end of yesterday I failed to offer in evidence the exhibits I had marked for identification. I am referring to the patents, charts and catalogues that were introduced yesterday. I would like to do so now nunc pro tunc.

The Court: They will be so admitted.

Cassius C. Palmer was thereupon called as a witness on behalf of the Defendant, and having been first duly sworn, testified as follows:

Direct Examination

By Mr. Frye:

Q. State your full name.

A. Cassius C. Palmer.

Q. Your age, residence and occupation?

A. My age is 83 past, and I live in New York.

Q. And occupation?

A. I am a designer of machines, particularly small refrigerating machines, below five ton capacity.

Q. Will you give us, briefly, a statement of the experience you have had in refrigerating apparatus, first of all let us know the duration of it, how long have you been in the refrigerating business?

A. I commenced to study refrigeration back in 1867, and I went actively in the business three years later.

Q. And have you been connected with the refrigerating business since that time?

A. With the exception of several years when I was unfortunate and ran short of funds, I have been in the refrigerating business ever since; given my life study practically to this business, and experimenting at the same time.

Q. Where were you residing when you first entered the refrigerating business?

A. San Francisco.

Q. Tell us what work in the refrigerating business you did while in the west, around or in San Francisco, and I would like not to ask each question, but state it if you can without specific questioning, and if not I will proceed to do so.

A. Perhaps it is as well to sart with the incentive that led me into the business. I was living in San Francisco in 1867 and at that time we were paying for ice for domestic use 5 cents a pound, a hundred dollars for a ton of 2,000 pounds, and naturally we were hunting for something that would produce ice cheaper than they were having to pay for it; all ice at that time was brought from Sitka, Alaska, by schooners. At the same time I was studying it there were three or four engineers and capitalists in the same state, that is, to say, there was three or four of them who had taken up the study of refrigeration and were giving their time and their money to developing refrigerating machines. One of them was using compressed air, one of them was using sulphur dioxide, one of them was using ammonia, and I was using ethyl chloride. At that time there was no data available on any of the refrigerating machines chemicals that was considered authentic, and I was particularly unfortunate in having a table on ethyl chloride unavailable until 1896, when Professor Gray of the Smithsonian Institute was in Paris and he found that in research by Greenault, and it contained two tables, and one of them was ethyl choride, but nothing had been made up, and from 1896 forward we had authentic data to compute from; before that it was a question largely of cut and try, as we say.

Q. Now about SO2, was data on that available ahead of that?

A. Yes, it was, but there was no one using it in San Francisco at that time. The Greenault Tables contained, I think, every chemical used in the refrigerating art at that time except ethyl chloride.

Q. That happened to be the refrigerant you were using, and accordingly you were searching for data on that particular refrigerant?

A. Yes.

Q. And you discovered data about practically all others except that, is that what you have said?

A. Yes, the text books all covered tables of all the other chemicals except ethyl chloride at that time.

Q. Now we are particularly interested in SO2. Who, for example, wrote any books or made any report on that particular refrigerant?

A. I am unable to answer that question for lack of information. I have not looked it up.

Q. Did you ever hear of Professor LaDue, I think it was?

A. Yes, Professor of one of the colleges, a technical man, and I think he was an authority on refrigerating chemicals.

Q. On SO2?

A. On all refrigerants.

Q. And in his works, you think you could have found data that would have helped you in using SO2 as well as other refrigerants?

A. Yes, I think we could.

Q. Now, you have reached the point in the story of your development work in San Francisco, and I interrupted you. Will you proceed to tell us what you did out there in the way of designing machinery in refrigeration work?

Mr. Cooper: This is not being used as prior use, is it, at all, because Mr. Palmer is not pleaded as a prior user?

Mr. Frye: Public use; this is prior art.

Q. You understand the question, Mr. Palmer?

A. No.

Q. Well, I wanted you, without a particular question each time, to tell us just what you designed and what you built out on the coast, and then we will proceed. I think we can shorten the time.

A. We built small refrigerating machines, particularly for experimental purposes. The first small machine we built contained four freezing cells that would produce about 150 pounds of ice on each cell, and from that we enlarged until we built as high as a two ton machine, using ethyl chloride as the refrigerating agent.

Q. Now, in those days did you use copper tubing in the refrigerating apparatus?

A. Entirely, yes sir.

Q. And have you since used copper tubing of various sizes—now, I am not speaking of any particular size—throughout practically your entire experience in refrigerating apparatus?

A. I adopted copper as the best that we could use for several reasons, one or two being that it was more easily handled, if there is a leak it is very easily soldered, and the tubes were flexible, and if in use, they were continually jarred, they would not change their tensile strength, the principal object being the ease of handling tubing and the fact that the transmission through light surfaces was rapid, more so than it would be with any iron we could get, or steel.

Q. Would ethyl chloride, for example, corrode copper tubing?

A. No, it is a neutral chemical when properly made.

Q. Now, you have several patents that I personally have seen on railway car refrigeration. Will you give us briefly a recital of your activities in that line?

A. The first car that we built—perhaps I will have to start at the beginning. In San Francisco and on the Pacific Coast particularly, we were at that time raising large quantities of fruits, and it was necessary to ship them east in order to dispose of them. We were using ice, originally in small boxes with ice; then afterwards, by putting ice in refrigerator cars, and looking to the future, we saw an immense field for the transportation of fruits from the Pacific Coast, and I turned my entire attention to the construction of refrigerator cars.

Q. About what period was this in years, if you can remember?

A. I am a little bit—on dates—to remember back 20 years—

Q. Well, perhaps I can refresh your recollection a little when I tell you that your patents run between 1887 or 1888 and 1901.

A. Now, that first car was built in 1881 at Philadelphia, at the Allison Car Works. At the same time we were applying for patents, which were issued to us in 1892. That was the original car which was operated by compressed air, driving an air cylinder, which is equivalent to an engine.

Q. What refrigerant did you use?

A. Ethyl chloride.

Q. Ethyl chloride?

A. Yes.

Q. How was the condenser formed? Was it water cooled or air cooled or both?

A. We experimented with air cooled and with water cooled both. In refrigerator cars in the crossing of the deserts, well, there is 24 or 48 hours that you run that you get no water. We had to use a small amount of water on the condenser as a safety factor; not that the air would not cool it in itself, but for the reason that we endeavored to guard against the worst possible conditions that we could get on the road.

Q. I am not certain that I understand you. You had a condenser that operated primarily on air, but you also did use water; is that what you said?

Mr. Cooper: I think that is a little bit leading. I think the witness ought to be allowed to state.

Mr. Frye: I would like him to enlarge on the last answer, to make certain we understand each other.

A. My original research was with compressed air, or with air alone. In using the words "Compressed air," that is air that was to drive the engine. This engine drove the compressor that handled the ethyl chloride.

Q. Now, go ahead, keep right on with that recital, please. What happened in the condenser?

A. It became, of course, heated from the compression of the chemical, and we used—to begin with, our first experiment, we used air alone.

Q. Now, did that first car you have talked about go into active use on a railway track?

A. Yes, between New York and Jersey City on the Pennsylvania Railroad. We ran the car all one summer.

Q. You said New York and Jersey City. Is that what you meant?

A. I meant Philadelphia and Jersey City.

Q. Yes, I thought they were pretty close to each other?

A. We operated that season with the compressed air as our source of power, to condense the chemicals.

Q. The condensed air operated the engine which in turn operated the compressor, is that the cycle?

A. That is the idea.

Q. You said one season. Was that all that you used the car for?

A. No, we used it afterwards in a trip from Chicago to New York, for dressed beef; I think the next year, the second year, we were experimenting with it.

The Court: Right there, let me ask you, how was the condenser cooled in that car?

The Witness: My recollection of it is that it was cooled entirely, that is, cooled in part, by the air that was taken by means of a fan, and in part by carrying the exhaust from the air engine through the head of the cylinder for cooling the heads, and then exhausted into the condenser, so that there was really two sources of heat absorption.

The Court: Did you use any water to cool that with?

The Witness: My recollection is that we did not use water when we first commenced. After each season we would put in some little refinements that we would think was necessary. After the first year I think we did use water.

The Court: That first year it was used on simply one car.

The Witness: One car, yes.

The Court: One car?

The Witness: Just one car, an experimental car built at the Allison Car Works.

Q. (By Mr. Frye). Who owned that car?

A. It was owned by my partner in the business, Mr. Seth Cook of San Francisco.

Q. You say that this was an experimental car, but you have also told us you used it for one season, and then in a later season, and then in a later season used it on shipments to Chicago—what was it, to New York?

A. From Chicago to Jersey City.

Q. And what did you carry, if you remember?

A. We purchased a load of dressed beef from Armour & Company and sent it to Toppe Brothers, Jersey City, who sold it and reported that it was in first class condition.

Q. About how many days would a trip like that take, in those days?

A. My recollection is that it took us four days.

Q. What was about the size of the copper tubes you used in your condenser in that first car?

A. ¾ inch O.D. 16 gauge copper.

Q. O.D. is "Outside diameter"?

A. Outside diameter, yes.

Q. What does 16 gauge mean, how thick a wall would that be?

A. It would be approximately 1-16 inch. It might vary a fraction from that; I have forgotten exactly what the tables are.

Q. Now, what was the size of that congealer tube, or expansion coil tubes?

A. They were ¾ inch, the same, made out of the same pipes.

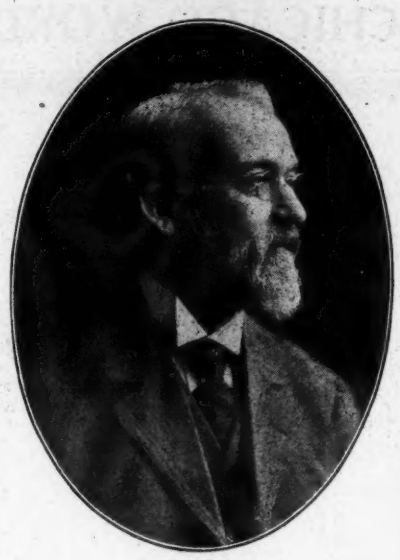
Q. They were the same size?

A. Made out of the same pipes.

Q. Now, let's go on. You built that one car and used it for at least two seasons. Now, what was the first car you built, if any?

A. A car about 36 foot length. We built it with platforms on both ends, so that we could ride on the platform and watch our machine, the car being loaded with any freight, that is perishable freight, and under the control of the railroad, being sealed so that we could not get in, the railroad company being responsible for the value of the load.

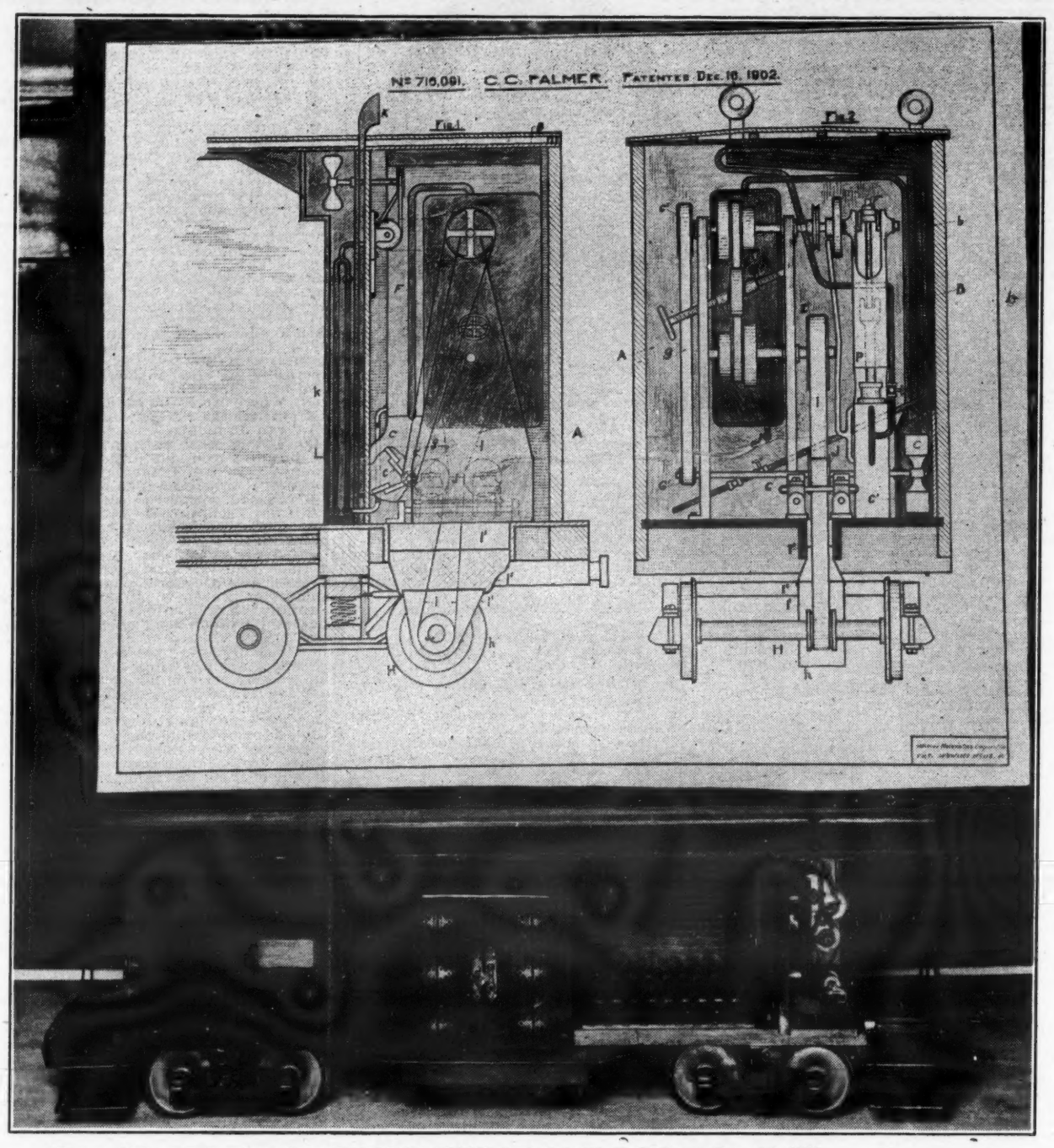
PIONEER



C. C. Palmer

Air Cooled Apparatus Used in Refrigerated Cars

MODEL OF PALMER'S REFRIGERATED CAR EXHIBITED AT CHICAGO WORLD'S FAIR, 1893



Above: Enlarged drawings from Patent No. 716,091 issued to C. C. Palmer, Dec. 16, 1902.
Below: Model of mechanically refrigerated freight car, built to scale for exhibition at the Chicago World's Fair.

Q. Well now, tell us a little of the use of this late car or cars?

A. We used that car as an exhibit. We used the second car we built in carrying fruit from the Pacific Coast to Chicago and New York and in carrying meat from New York to Jacksonville, Florida, and later we used them in carrying dressed beef from Indianapolis to Boston.

Q. Was it on the Western trips that you came in contact with the deserts that you have spoken of?

A. On the trip to San Francisco, we went over the Humboldt desert, and on the trip to Southern California we went over the Mojave desert.

Q. Now, what was the difference, if any, in the construction of your refrigerating apparatus between your later cars and the first car you have told us about?

A. The construction of the condensers and the refrigerators was practically the same in both cases, and the circulation of the air from its chill room was the same. I do not recall anything except small refinements that were changed from the time the car with the platform was built.

One object of building the platform was so that we would take anyone along the road up on to the platform when the train was in motion, and show them the results, show them the machine in operation and tell them the results. In that way, I took a great deal of pains to ask the opinion of men, the brakemen and yard men, and in that way I gained some information that was useful in operating the car.

Q. Well now, certain of your patents show a refrigerating car wherein there are condenser tubes covered with, I believe, outside fibrous material or canvas or something of that kind, and a tank of water which was apparently sprayed or dripped on to this canvas?

A. Yes.

Q. Now, will you explain when you used a construction of this kind in a condenser, that is, if you did?

A. In the second car we built, we used a water system. That is, the car with the platforms.

Q. Now, when you say water system, do you mean water and air?

A. Water and air combined. The object of that was to cause a greater absorption capacity of heat by the aid of the evaporation of the water from the surface of the condenser; in that way we took advantage of the fact that water in changing into gas absorbs approximately 900 B. T. U.'s.

Q. Did you also draw air by means of a fan over the tubes of the condenser?

A. We did.

Mr. Cooper: I think it would be better to ask the gentleman his recollection and not state it in leading form.

Q. Did you hear the question?

(Question read by the reporter.)

A. Yes.

Q. And did such air co-operate with the water in that particular condenser?

A. Yes.

Q. Now when was it you used that, in years, if you remember?

A. Probably 1884, as near as I can remember.

Q. Then for how long, if you can remember?

A. Well, we have been using that since, since the original research.

Q. Now the water that you used in addition to the air on a refrigerating car, was that used over and over again?

A. Yes, we carried a tank underneath the car between the trucks, and had a pump that would pump the water on to the condenser, and what remained that was not evaporated we led back again to the tank to be used over and over again, and in that way, with one tank of water we could go through the Mojave or Humboldt desert without any trouble whatever, and even the railroad companies operating out there have to carry tanks of water for their engines in that section of the railroad.

Q. Have you ever built or designed or had any connection with refrigerators other than in railroad cars?

A. Small machines, yes.

Q. Where was it you were located when you were connected with what you call the small machines?

A. At that time—you mean the shop?

Q. Well, no, what part of the country?

A. I lived in San Francisco during all those experiments.

Q. I think you misunderstood me. Where did you build or your company build what you have termed the small refrigerators for the market?

A. Originally we made some at Derby, Connecticut, and afterwards we built them at the Bayonne shops of the Electric Dynamic Company, that was our principal place, and in later years had a shop of our own.

Q. What was the name of the first company that you operated under, you and your associates in Connecticut?

A. Railway Stationary Refrigerating Company.

Q. Railway Stationary Refrigerating Company?

A. Yes, sir.

Q. And where was that company organized if you remember?

A. My recollection is it was about 1900.

Q. And how long did it continue in operation?

A. Well, they went into a receiver's hands five or six years ago; I can't give you the exact date.

Q. Was it still in the same name?

A. No, the Railway Stationary Refrigerating Company was succeeded by the Clothel Company, who purchased all their machinery and all their rights, etc., in other words, they changed the name of the Railway Stationary Refrigerating Company to the Clothel Company.

Mr. Cooper: It was the Clothel Company that went into receivership.

The Witness: Yes.

Q. Now what was the thing that was manufactured by either the Railway Stationary Company or the Clothel Company with relation to the refrigerating apparatus other than railway cars?

Mr. Cooper: Neither of these is plead, neither the Railway Stationary Refrigerating Company nor the Clothel Company is plead as a prior user. You are not putting it in for that purpose, I take it?

Mr. Frye: No. Whenever we do we will call your attention to it.

Q. What was it you made for those companies other than refrigerating cars?

A. Small refrigerating machines.

Q. And did you continue to make those during the years you have mentioned from 1900 up to five or six years ago?

A. Yes.

Q. What was your personal connection with those companies?

A. Chief engineer for a time, and vice president for a time, the majority of the time as chief engineer.

Q. Were you familiar with the catalogues put out by the company during those years?

A. Yes, I compiled them really.

Q. I call your attention to what purports to be a catalogue of the Clothel Company, stamped in red ink, and with the printing on it: "Railway Stationary Refrigerating Company, New York City," and ask you if you recognize that catalogue?

A. I do.

Q. What is it?

A. It is a catalogue of a small refrigerating box, on the front page, such as would be used in a country home for household or other uses.

Q. When do you remember this particular one was used by your company or companies?

A. From the time the Stationary Railway Refrigerating Company was in operation, and latterly by the Clothel Company, if I understand you.

Q. About what years would that have been, and I would rather have it in dates if you can remember?

A. In 1901-1902, to the best of my recollection.

Q. Well, when did the Clothel Company take that over?

A. About 1906.

Q. Now, I call your attention to what purports to be a catalogue of the Clothel Company, 90 West Street, New York, this being marked Exhibit 44, and ask you if you recognize that catalogue?

A. I do.

Q. What is that one?

A. That shows refrigerating machines, and also shows the parts complete, that is, compressor, and also the condenser, in tube form.

Q. When, if you recollect, was this particular catalogue put out by your company or companies?

A. Well, it was shortly after the Clothel Company was organized, and I presume it was in 1906 or 1907.

Q. It was certainly ahead of 1913, was it?

A. Yes.

Q. You are sure of that?

A. Sure, yes.

Q. Now, on the second page, apparently, of this catalogue which has been marked for identification, exhibit 44, is marked what appears to be a table of pressure temperature relations. Was that table prepared by you personally?

A. I compiled it, yes, from data taken from text books.

Q. And when compiled you considered it correct, I take it?

A. As in general it compares—it is correct as compared with all the other tables of like nature in text books.

Q. At the bottom of such table is a list of what was marked "Authorities." Were those test books or something of the kind that you personally looked up in preparation of the table?

A. Yes, I took them from the text books, all of them.

Q. Now, on page 10 of this exhibit 44, is shown a cut, and below that descriptive matter what is termed Horizontal Condensers and Coolers. Will you explain if that means that you used the same parts for either condensers or coolers?

A. We could use the same parts with either condensers or coolers in that brine system.

Q. Well, did you actually do so?

A. Yes, we did, in some instances.

Q. If you will note about the third line down it says they contain corrugated copper tubes.

A. Yes.

Q. About what diameter were those copper tubes, if you know?

A. ¾ O. D., 16 gauge corrugated.

Q. Now, during those years that you were building refrigeration apparatus did you consider that there was any difference in apparatus for household use than for other uses?

A. No, so far as the design of the machine was concerned, the same physical laws had to be adhered to, and it would be the same thing in either the compressor or refrigerator, in other words, you could build a machine and have the condenser and refrigerating coils exactly alike if you so chose.

Q. Could you build a certain size machine and use it in there, indoors or outdoors, in a butcher shop or a residence, or a battleship, would it make any difference to you in designing your apparatus?

A. Simply a question of capacity.

Q. And dimensions, is that the idea?

A. That is the idea, yes. The same laws govern in all cases.

Q. Now, let us assume an example where we used ¾ inch copper tubing in a machine of the capacity we will say of 500 pounds a day refrigeration. Did you use those tubes in such capacity machine?

A. I did not catch that.

Q. Suppose in a hypothetical case you had a machine designed with ¾ inch copper tubing in this condenser, and the capacity of the machine is 500 pounds. Now, is that a fair comparison? Can you use a machine of that capacity with ¾ inch copper tube condensers?

A. It could be, yes.

Q. Now how would you go about it as an experienced designer to make a machine to turn out a capacity of 100 pounds a day?

A. By reducing the size of both the condenser and refrigerator, in other words, to reduce the size of the radiation surfaces of your pipes.

Q. Would you also reduce the size of the compressor?

A. Yes.

Q. Are we to understand there would be a general reduction in sizes of any particular parts to the exclusion of others? Which do you mean?

A. I can't just get all of that.

(Question read by the reporter.)

The Witness: If you were designing a 500 pound machine, to design a 100 pound machine, an engineer would probably make no change; it would cost practically the same thing to build a smaller unit that it would a 500 pound, in other words, you could use the cylinder compressor of the 500 pound machine on the 100 pound machine by reducing the speed; it would not pay to build a separate compressor, and those two sizes are near alike.

Q. You would regard both of those sizes as small refrigerators, would you?

A. Yes.

Q. Now, can you work that the reverse way. Suppose you have the compressors and condensers, and so forth for a 100 pound capacity machine, and you desired to build a 500 pound capacity, what would you have to do?

A. It would be, in a case like that, it would be necessary probably to build a little larger compressor, because you could not run the small compressor at high speed enough without danger of overheating.

Q. And when that occurs you redesign with larger sized parts, is that the idea?

A. Yes, particularly the compressor.

Q. And would you also change to any extent the remainder of the apparatus, such as condensers and expansion coils?

A. Yes, if you started from 100 pounds, if you were building a 500 pound you would want to increase your condenser pipes and your refrigerator pipes also.

Q. Now, is that true whether you use water or air and air and water combined for the cooling medium around your condensers?

A. Yes, it is a question of absorption of heat in your condenser, and in order to get rid of that heat you can use either air or water or the combined two?

Q. And under any of those conditions your answer stands?

A. Yes.

Q. Now during this long experience of yours in refrigerating apparatus tell us whether or not copper tubing was or was not a familiar article around the work shop or factory?

A. Yes, it was, the same as gas pipe and water pipe.

Q. Various sizes of copper tubing?

A. Various sizes, yes.

Q. Have you ever seen ⅜ inch copper tubing about and used in refrigerating apparatus?

A. Well, we used it on gauges and an oil feed, and it could be used anywhere.

Q. About how great a pressure can the ⅜ inch copper tube withstand to your knowledge?

A. I don't know that I ought to answer that question, because my knowledge is limited on test piping.

Q. Well let us put it this way: How high do you remember a gauge pressure for ⅜" copper tubing was used?

A. Well, we never had over 40 or 50 pounds in our work, we rarely ran but about 20, but from hearsay, or from any knowledge of the tubing, a ⅜ inch tube should stand a thousand or 1,200 pounds to the square inch pressure.

Q. In your particular apparatus you do not ever need to have high pressures?

A. No, using low pressures altogether.

Q. And let me ask you, is ethyl chloride, when used at ordinary condenser pressures, above or below the pressure that is necessary for SO2?

A. The pressures are below, SO2 compression pressures are much higher than the ethyl chloride.

The Court: At what pressure of the atmosphere, of the atmospherical temperature, will ethyl chloride go to liquid at ordinary heat?

The Witness: The pressures vary as the water of your condenser varies. At 65 temperature of the condenser pressures run about 15 pounds to the square inch.

The Court: In ordinary atmosphere like we have here.

The Witness: Yes.

The Court: How many pounds?

The Witness: 15 pounds to the square inch.

Q. Let us take 80 degrees temperature, about what would you have ethyl chloride pressure?

A. About 18 pounds.

Q. Not over 20 or 25, somewhere in there at the most?

A. No, it would not exceed 20 or 25.

The Court: Can you give the symbols for the ethyl and methyl chloride?

Mr. Cooper: I have it here, ethyl chloride is C_2H_5Cl. Methyl chloride CH_3Cl.

The Court: Now, I guess that tells me what they are, doesn't it?

The Witness: Yes. To put it in ordinary language, ethyl chloride is made from grain alcohol and hydrochloric acid mixed and distilled. Methyl chloride is made from wood alcohol and hydrochloric acid.

Q. Did you ever see a refrigerating apparatus built by Messrs. Martin and Beath?

A. Yes.

Q. Where was that located?

A. In San Francisco. The original search of mine in 1867 on to 1882 was made when in San Francisco, and both Martin and Beath were experimenting with ammonia at the same time; I was personally acquainted with both of them. They used ammonia, there were other parties using sulphuric ether, and one using compressed air, and we were working together; we lacked data, we were working on what we called the cut and try principle, without any computing.

Q. That was around 1860, in the 1860's and 1870's?

A. Yes, up until about 1870.

Q. Now, can you tell us, without going into details, whether the Martin and Beath apparatus was an operative apparatus?

Mr. Cooper: Now, if your Honor please, there is no allegation in the answer of prior use of this Martin and Beath thing.

The Court: Is there a patent?

Mr. Frye: Yes.

The Court: Well, I think where they plead a patent they have a right to show whether it was something more than a mere paper patent or otherwise.

Mr. Frye: And my colleague spent some time yesterday trying to demonstrate that the patent was inoperative, as I understand it.

Mr. Cooper: I think your colleague was trying to demonstrate it would work, and I was trying to demonstrate that your drawings were wrong.

Mr. Frye: If the drawings are wrong it is my mistake, and I am sorry.

Q. I want to know whether the machine itself, to your personal knowledge, was an operative machine, Mr. Palmer?

A. The original research machines were more in experimental form, but they produced the results, but they were afterwards changed by little additions to them, as all refrigerating machines have been made.

Q. There were refinements from time to time you mean?

A. Yes, refinements, that is the word I omitted.

Q. Would you give it as your opinion as an engineer that it was a workable machine or an inoperative machine?

A. It was a workable machine.

Q. They, of course, have had—

A. I can add to that that the original research of Beath and Martin was partially with the aid of blue prints that I had received from a friend of mine who bought a machine in Prussia, and before that Beath had been experimenting with compressed air, and when I received these blue prints they were used as a foundation, really of their experiments.

Q. So that you were familiar from its inception, so to speak,

A. Yes.

Q. Now there was a patent of yours, number 716091, talked about yesterday, and there was a question about its operation, if I remember. Will you tell his Honor how the air that you took in and put out by the fan C, emerged from the compartment that contained the condenser?

Mr. Cooper: Are you calling upon him to explain the drawing?

Mr. Frye: I want him to tell us what the patent does not show in so many words, but implies.

Mr. Cooper: I don't think that is the way to do it, the patent has to speak for itself, it certainly cannot be supplemented by the patentee's statement of what he intended to show.

The Court: Overruled.

Mr. Cooper: I will take an exception

Q. Do you understand the question?

A. The fan as located received its air from an opening below the fan, and it was carried over the pipes through the funnel at the left.

Q. The funnel at the left in the figure, and the enlarged chart before us?

A. Yes.

Q. And was the intake at the right?

A. The intake was through the floor. That, I think, was to carry air in around the machines, and the other, I am not positive about that.

Q. Well, take a look at the other figure that is marked "Figure 1." There is an intake that moves down apparently from the roof to the fan adjacent to the floor passing through what would appear to be two compartments, or between what would appear to be two compartments. Testimony was given in this case that that incoming air would be cooled by the expansion coils.

A. The partition between the machine room and the storage room was insulated, the same as the balance of the car, the machine room itself had no insulation, it could not absorb any heat from the refrigerating room except through those heavy walls, and my recollection is that that had an extra insulation in that partition.

Q. Have you ever made and/or exhibited a model that would show us, in your opinion, your railway car design?

A. I have. It is a model made from the operating machine, and while it represents no particular patent complete, it has the refinements taken from experience and put into the one complete model, as the final cars were built.

Mr. Frye: Now, your Honor, this particular model is here, but it has not been pleaded as a prior use. I do not want to put it in and then be in the anomalous position of "Here is a prior use, we do not intend it." This particular model, as I understand it, is not an operable model. It is merely a showing of where parts are located. In my opinion I think it is admissible, but I would like to discuss before we bring it out, rather than afterwards.

Mr. Cooper: Why, I have no objection to the thing as a model made at the present time to illustrate what the witness has been talking about.

Mr. Frye: When was this model made? Just to get that?

Mr. Cooper: No, no—

Armour Company Opposed Use of Palmer Cars

Q. It was made, as I understand it, in the ages bygone, wasn't it?
A. About 1900—was exhibited in the World's fair of 1903.
Q. 1903 or 1893?
A. 1893, yes.
Mr. Frye: Knowing what it is, as I say, I would like to show it to inform his honor, as to what the Palmer device generally is. I do not want to be in a position of anything more than an illustrative proposition, and we would like, in fact, to merely show it without an exhibit, withdraw it from the case, if that will do any particular good.
Mr. Cooper: It won't to me. I do not see how you can put evidence in, like one of these small mice on a string and then pull it out again. If you want the evidence, I won't object to it for use in connection with the witness' explanation, or as illustrating what the witness said, but it is supposed to be in a box somewhere, and you ask me to agree that it can be pulled out again. I won't agree.
The Court: The counsel has said he is willing to have it offered as illustrating his testimony.
Mr. Frye: It happens that the witness has a particular fondness for this one, and he does not want to leave it in the custody of the court. This witness just arrived yesterday, and we have not had much opportunity—now, I am perfectly willing to assume custody and so forth but under the circumstances I would rather not show it than to have to keep it around here for the next year or two on appeal. That is the reason for discussing it now.
The Court: I will let you show it, and let the witness keep it under some arrangement and it can be produced in the Court of appeals when you want it, but let him keep it in the meantime instead of the Court and counsel keeping it.
Mr. Cooper: It may be that after the mystery has been revealed to us, the whole thing will blow up like many other defenses.
Mr. Frye: There is no mystery. We will show it to you first.
The Court: Aren't you both willing that it be shown to this Court, and then the witness keep it instead of counsel?
Mr. Cooper: I am embarrassed to make a stipulation. Let's have it out, and let's take a look at it. Of course, I would not keep the court from seeing it, but if it is going to be a matter of evidence in any sense, I will look at it before I will say what I will do about it.
The Court: Maybe you would like a short recess.
(Recess.)
Q. (By Mr. Frye) Now, will you explain to his Honor what the model before us purports to show—in the meantime, marking the model for identification, exhibit number 45.
(The model referred to was thereupon marked for identification, exhibit 45.)
A. Refrigerator car containing all the refinements up to the time the car was built. While it is not representative of any one particular patent, it contains features in several of them, but it, in itself, was the complete operating machine. The car is to a scale and the machine is to a scale, as near as it is practicable to be made.
The operation of the machine, the ethyl chloride is placed in the refrigerator pipes instead of the cooling space.
The Court: Where did you actually put it in?
The Witness: It is built in grids.
The Court: How would you fill it with the ethyl?
The Witness: We would fill it two-thirds full with ethyl chloride.
The Court: Fill it in gaseous form or in a liquid.
The Witness: In the liquid.
The Court: Liquid form?
The Witness: Yes, under pressure.
The Court: Did you have a valve in the top of it?
The Witness: We had connecting pipes from there to the condenser, both top and bottom, and an expansion valve on the inside of the car so we could reach it. Ethyl chloride was evaporated by means of this compressor located in the machine room, compressed the gas in the condenser running across the top and down the side.
The Court: You don't mean it was evaporated by the compressor?
The Witness: No evaporated in these pipes in the car, that is what produces the cold, because being filled with heat, the gas is compressed in the condenser, gives off that heat, and the liquid at the bottom is led back through that lower pipe through the partition in the grids again.
Mr. Cooper: That condenser is covered with a fabric cover, isn't it?
The Witness: Yes, that is what we used last.
Mr. Cooper: What kind of fabric is that?
The Witness: It is simply a piece of canvas laid on top of the pipes, and coming down about two-thirds of the way, the idea being to spray the water and dampen it, then the current of air coming over the pipes carried the heat away.
Mr. Frye: Which direction was your current of air, from the bottom up, or from the top down?
The Witness: We used, latterly from the bottom up.
Mr. Frye: Now, show his Honor where your fan for conveying that air was located.
The Witness: At the floor in the bottom and belted to the compressor shaft.
Mr. Frye: Do you see that little round fan, your Honor?
The Witness: It discharges into the bottom here.
The Court: Where is the fan?
The Witness: This is the fan driven from the compressor shaft. The air in this case goes from above the fan over the pipes, and out at the top.
The Court: So that does not show a fan.
The Witness: Well, no, it is too small; you cannot show it in detail on account of the size.
Q. Now, you say the air comes up from the fan and out the opening in the top of the car?
A. Yes. These friction cones were used to change the speed more or less.
The Court: Where is the lever that you shift it with?
The Witness: We unloosen these two idler pulleys and stop the whole machine in that way, if we want to shut down. Perhaps it is well to explain, these idlers. From the axle, you have to compensate for your spring motion, which amounts to four or five inches sometimes. To do that, we pass a belt from this pulley down to the pulley on the shaft. To compensate for the extreme motion of the car, bring up the slack, the slack is taken up by two idlers on a common carriage. If this is the direction of the car, this takes the straight pull, this takes the slack. If your car reverses, this takes the straight pull and this takes the slack (indicating), they being held together by a spring moving on them together. It makes perfect connection and it makes perfect work.
Q. Now, you have shown in both your condenser and in your—what term do you use, evaporator?
A. We call them refrigerating grids.
Q. Well, it is what we have variously called congealer or evaporator or expansion coils?
A. Yes, refrigerator.
Q. Yes. In the model, I believe you said, or did you say, what they were made of? Are they wires or tubes?
A. In the model these are all made of wires, they being so small you could not get a tube of that size.
Q. Well, in the actual machine, in the full size car, what were those tubes made of?
A. Of 16 gauge copper, ¾ O.D.
Q. In both the condenser—
A. Both the condenser and the refrigerator, the only difference being that we made double the number of tubes, perhaps, in the grid that we did in the condenser, but the condensers were made sufficiently long to compensate for it.
The Court: What would that make the opening in that tube?
Mr. Frye: It would be 1-16 on each side, and 1-8 off of a quarter. It would be ⅝. That is high school mathematics—maybe I had better let somebody else answer you.
Mr. Cooper: You said 1-16 off? It would be ½ inch off, wouldn't it?
The Witness: The operation of the car—perhaps we better explain to your Honor, the way we handle the air in the car, as that is quite an important factor:
It is very desirable that it be dry; your dryness is really as important as the temperature.
By a fan connected through the partition and over the grid, we draw the air in a tube extending the length of the car, and perforated to give us—we draw the hot air, pass it down by means of this fan, down below this and back under the low—you will see it raised the load from the floor, so that the air gets underneath. In that way, you always have your cold air at the bottom, gradually working up.
Now, that absorbs the heat from your load, which in the case of fruit is at times very strong, and every time you pass that, you not only dry but you take the carbonic acid gases that are generated from the ripening fruit. You can collect those into moisture, and it is taken out of the car through a drain at the bottom, and in that way we can handle any class of perishable freight, whether it is dressed beef or fruit.
Of course, our main object at the time was to produce a car to handle fruit.
The Court: Were there ever more than two cars built?
The Witness: Yes, we built ten.

Opposition by Armour & Co. who had contract with railroads requiring exclusive use of their cars.

The Court: You built ten?
The Witness: Built ten, and operated them for I guess a couple of years in the summer, and made practical tests, but we had an opposition from Armour and Company at that time. They had a contract with all the railroads in the United States that no cars would be permitted, except the Armour cars, in the fruit region of San Francisco. The Merchants Despatch Company, when their cars passed Ogden, had no claim on the mileage of the car, and that was their earning capacity, or part of it—until the Interstate Commerce Commission annulled that, we were bothered not only in that way, but with their stealing the cars, and diverting them, the result being that Mr. Rice, who was then backing me in it, concluded that the best way would be to wait until the railroads were willing to pay their share. Before that we were doing it all on our own money.
Q. When was the annulment of the Interstate Commerce Commission that you spoke of—when did that take place?
A. I cannot answer that question, because there is so many years.
Q. Was it one year or several years, in your recollection?
A. Oh, it is several years.
Q. Later?
A. Yes, it must be eight or nine years.
The Court: This model was made after you had built the ten, or at what period?
The Witness: It was made about the time when we built the ten.
The Court: How many patents did you secure?
The Witness: Well, I presume I have—referring to the car, and referring to refrigerating machinery in general, I presume I have eight or ten patents. I had over 30 patents, but part of them were for other purposes?
The Court: What I was getting at, whether this model was made at—represented your various developments, or whether they came before.
The Witness: It represents really all of the major portion of the improvements.
The Court: It rather followed.
The Witness: Yes.
Mr. Frye: That is, up to 1893—that is when this model was built.
The Witness: Yes.
The Court: That was before you went into your so-called small—
The Witness: Yes, until that time I was working mostly on the car. That was my hobby.
Mr. Frye: Take the witness.

Cross Examination

By Mr. Cooper:
Q. This model does not have the specific improvements to which this patent of yours, No. 716091, was directed, does it? The model does not show that particular arrangement of your patent No. 716091?
A. No, as I stated, this contains the better points which I mentioned in several of the patents, and does not represent any particular patent, does not conform to,—
Q. This Mr. Rice whom you mentioned as your backer, who was he?
A. Isaac L. Rice.
Q. Isaac L. Rice; he was the very wealthy man in New York?
A. Yes, connected with the Electro Dynamic Company.
Q. And one of the submarine boat companies?
A. Yes, sir.
Q. And a storage battery company of Philadelphia?
A. Yes.
Q. And a good many other industries?
A. Yes.
Q. And he was also, I think, a great patron of the chess players, wasn't he?
A. Yes, that was one of his hobbies, and probably was the cause of his death.
Q. And one of the best known men in New York, in his time?
A. Yes.
Q. How long ago was it, about what year, that Mr. Rice and you dropped the refrigerator car business?
A. About 1908 or 1909. The question of memory,—there were so many of them.
Q. Something on the order of twenty years ago?
A. Pretty near, I presume.
Q. Now, referring to the catalog that is in evidence as exhibit 44, and directing your attention to the illustration on page 10, there is a heading "Horizontal Condensers and Coolers," and then a cut there. Now, as I understand, on the left-hand end of that cut there is a couple, or you might call it a junction box, with openings at either end, above and below?
A. I presume that is the inlet to the coil pipe, into the interior between,—
Q. Between?
A. No, into the tubes, the head of the chamber, into the tubes. The gas goes into that chamber and through the tubes on the interior. The air, if you are using air, would go into the shell and be cooled by the tubes.
Q. That is, that the hand hole which was bolted on top,—
A. Probably a flange.
Q. There seems to be a hole in the middle?
A. Yes.
Q. And immediately beneath that, what may be a pipe connection?
A. Yes.
Q. According to your recollection, that would be the water circulation through there?
A. It could be made the water circulation through there, or it could be made the brine, if you would want to make a brine cooler of it.
Q. In any event, that would be where you would have your circulation of water to absorb the heat in the condenser coils?
A. You may use it either way; you may carry your water through into this chamber at the end and through the tubes, inside the tubes, and have your chemical on the outside of the tubes. That could be done.
Q. I am speaking of it as a condenser?
A. As a condenser, the gas would go in and around the tubes on the outside.
Q. And the tubes would carry water through?
A. Would carry water through.
Q. And gas would go over them in this type of condenser?
A. Yes.
Q. That is the way your household or small condenser,—
A. One of the ways, yes.
Q. That is the way that is illustrated here?
A. Yes.
Q. Now, at the bottom of that page I notice a table, apparently referring to the same condensers, and the top line of figures on that table begins "4 PP"—what would that indicate? It says "catalog No. 4 PP." I suppose that was some factory designation for the condenser.
A. Yes, those are the manufacturing dimensions of the different sizes and styles. Then we bought those condensers, or had them made to order, and the firm used their catalog, we used their catalog for identification.
Q. And the smallest size of condenser which is on that table is 700 pounds?
A. Yes, that's what it says.
Q. And the largest size weighed 3,750 pounds?
A. Yes. We didn't use these. That catalog was put in there, the shell and tube was made for us at smaller sizes, to my recollection.
Q. You have a recollection that they were made of smaller size, but the smallest one advertised weighed 700 pounds, for the condenser alone?
A. Yes, sir.
Q. And then the cooler would weigh, as I understand you, as much as the condenser?
A. Yes, we made them smaller than that, but that is, where the catalog shows them, their stock.
Q. Now, I notice on the catalog that you have one style advertised and partially described on page 6, which was called a four-ton stationary machine?
A. Yes. That is the capacity of that compressor to handle sufficient gas to produce four tons of refrigeration per day.
Q. And on the next page a three-ton marine machine?
A. Yes.
Q. That would produce three tons?
A. Equivalent to three tons refrigeration, yes.
Q. And the only other one that I observed is on the next succeeding page, 8, which is called "special half ton machine"?
A. Yes, that was for use in soda-water fountains.
Q. And those three sizes are the only three described here in this catalog?
A. Yes.
Q. And with which of those three did you equip the condenser of 700 pounds weight?
A. I am not,—I can not recollect sufficiently to tell that. It is too much detail.
Q. And, of course, you do not recall whether in four-ton refrigeration type, you used as large a condenser as 3,750 pounds weight?
A. Probably not.
Q. What would be your guess about that?
A. I would not undertake that.
Q. You never, I suppose, examined Martin and Beath's patent, did you?
A. No, sir.
Q. And, of course, you have no means of knowing whether the machine they finally got up after the little additions and refinements from time to time, looked like their patent, or looked different from their patent?
A. I have no means of knowing what their patents were. I have never examined them.
Q. Can you fix the time when the blueprints came over from Germany,—Halle, I think you said?
A. Yes.
Q. Do you know about what time that was?
A. About 1870.
Q. It was at that time that you received them?
A. When I first commenced the study of refrigerating.
Q. And how did you come to procure them?
A. At the hotel that I was living at in San Francisco, was a gentleman who was on his way from Singapore going to Europe to buy a refrigerating machine to use in Singapore. He had missed his connecting line on the steamer, so that he had to remain 15 days in San Francisco, and we became pretty well acquainted. He told me what he was going after, and I asked him as a favor if he would get a duplicate set of blueprints for me, and he did so, and on his road back he brought them to me.
Q. That was—I suppose his return trip was several months—.
A. Yes, after he had been over there and been around to different manufacturers, and brought this machine.
Q. How definitely can you fix his return as being in 1870, or is that a matter only of general recollection?
A. General recollection, that is all. I have no means of knowing.
Q. It might be a year or two more or less?
A. It might be a year or two more or less.
Q. Either way?
A. Yes.
Q. At any rate, some time after you got the blueprints, you made them accessible to Martin and Beath, and then came some changes in their machine?
A. Yes.
Q. How long after it was that they made the changes, you, of course, cannot recall, after this lapse?
A. No, I would not undertake to say that.
Q. That little model that is here in evidence, did that represent generally the platforms that you built or arranged on the ends of the cars?
A. No, it was built for exhibiting the machine. Those platforms were put on for the purpose of carrying our friends on the platform so that they could see the machine in operation. Of course, the opposite platform would be vacant, but the platform was put on for appearances.
Q. What size was the refrigerator car?
A. The car was 36 feet long.
Q. That would be between the bumpers or inside?
A. No, 36 feet over all.
Q. That—that is, between bumpers?
A. Yes, the ends of the car.
Q. Between the ends of the car; and what would the inside dimensions be?
A. About 31 or 32 feet long, probably six feet wide and eight feet—no, seven feet high in the clear, as a recollection.
Q. Not more than six feet wide?
A. I think they were eight over all, outside dimensions. You would take off your insulation. That will be ten inches.
Q. You put something like 6 x 8?
A. It was a standard refrigeration car as built at that time, by the railroads, built after the drawings of one of the western roads.
Q. Will you give it of the order of 6 x 8 x 33, something like that?
A. Well, yes.
Q. Something on the order, then, of 1550 to 1600 cubic feet?
The Court: Then off from that would have to come the room where the machinery was, wouldn't it?
The Witness: The machine room was taken from the capacity of the car.
The Court: You subtracted that before you gave us—
The Witness: There is an insulator partition in that end of the car next to the machine.
Mr. Cooper: So that we get somewhere around 1550 feet?
A. In that neighborhood.
Q. Something in that neighborhood?
A. Yes.
The Court: About how long were your platforms?
The Witness: I think they were 26 inches. I am not positive about that.
Q. In those cars as you equipped them, all the power was derived from the car axle?
A. Yes.
Q. And I presume that that was an objection stated by the railroad?
A. The objection to some, from the fact that we wanted to send an inspector along, and they did not care to furnish transportation. That was the principal objection. The question of power taken from the railroads itself was never a serious matter with us.
Q. I did not mean as to the power, but as to the fact: when the car would be standing, there would be no power to run the refrigerator. That was an objection made to it?
A. In our work we demonstrated that we could stand a lavover of six or eight hours without any trouble whatever, on account of good insulation of the car.
Q. But when you get above ten or twelve, if there were tie-ups—
A. There were chances then, but if we could move the car in any direction you could get your machine in operation.
Q. And your proposition about the inspector was that there should be, if the things were put in regular service, one man for each how many cars, 4 or 5?
A. Six.
Q. Six cars; and one man would have to go on every trip?
A. Yes.
The Court: Didn't they furnish always free transportation for each car?
(Some discussion at this point off the record).
Mr. Frye: Except for having these various exhibits offered in evidence for identification admitted in evidence—
Mr. Cooper: I understand they are all offered in evidence, and I haven't any objection except the objections I took as I went along, in all of which I was uniformly unsuccessful.
The Court: Well, just so the record may be clear, what is the arrangement about the model?
Mr. Cooper: Why, of course Mr. Palmer can take it back. I don't care anything any more for it.
The Court: And if they want either side to produce it they can arrange with Mr. Palmer to produce it?
Mr. Frye: May not we have a photograph or something on each side?
Mr. Cooper: As far as I am concerned you can have photographs of it taken and have them filed in lieu of the exhibit when they are made.
Mr. Frye: I will be glad to do that. That is all, Mr. Palmer.
The Court: Anybody that wants to arrange with Mr. Palmer to take it to the Court of appeals—
Mr. Frye: We understand it is in the custody of Mr. Palmer and he can take it there if he likes.
The Court: Yes, it is for him to take it back and keep.
Mr. Frye: We rest, your Honor.

J. G. King, Chief Refrigeration Engineer, Frigidaire Corp., tells of his experiments.

Jesse G. King was thereupon called as a witness on behalf of the Plaintiff and having been first duly sworn, testified as follows:

Direct Examination

By Mr. Cooper:
Q. Your full name?
A. Jesse G. King.
Q. You live in Dayton, Ohio?
A. Yes sir, I reside in Dayton, Ohio.
Q. And what is your employment?
A. I am with the Frigidaire Corporation with the title of Chief Refrigeration Engineer.
Q. You are technically educated?
A. Yes, sir.
Q. State the place?
A. I first attended polytechnic college at Terre Haute but did not graduate there, and I went from there to the Bliss Electric School and graduated from there and then went to the Westinghouse Company in an engineering course. I am a member of the American Society of Refrigeration Engineers, and for several years was a member of the National Society of Practical Refrigeration Engineers.
Q. When did you first have anything to do in a practical way with refrigeration?
A. I think it was about 1911 that I designed some small ammonia machines.
Q. Of what capacity?
A. Well they were used on about a one-horsepower motor giving about half a ton capacity, according to the speed.
Q. And what character of condenser?
A. Water cooled condenser of the double pipe construction.
Q. Then when again did you come in contact with refrigeration engineering?
A. You mean in the engineering?
Q. Well, either as an engineer or in business contact?
A. Well, as an engineer in active business contact it was in 1918.
Q. By that time you were with the General Motors subsidiary?
A. Well at that time it was the Dayton Metal Products Research Laboratory which later became the General Motors.
Q. And you were there engaged in some department of refrigeration?
A. Why, I was employed to do research work on household refrigeration.
Q. Since that time you have been in constant contact with refrigeration and its problems?
A. I have.
Q. Did you at any time come in contact with refrigerators of the household type known as Isko and Domelre?
A. I did.
Q. What kind were they?
A. Previous to 1918 I had been with the Domestic Engineering Company, which later became part of General Motors, and the air cooled Isko machine was sent to the Domestic Engineering Company for them to look over, because we are all the time being submitted devices that we attach to farm lighting systems, and it was sent there for their observation, and I, naturally, as an engineer, took some interest in it.
Q. Well did you, at about the same time get other types or makes?
A. Not until 1918.
Q. About 1918 you got what makes at that time?
A. Well, in my work at the research laboratory, I tried to get hold of as many different types of household refrigerators as I could in order to investigate them, and in 1918 I had an air cooled Kelvinator, as I remember, a Guardian water cooled job, which later became the Frigidaire; I had a small ammonia machine job built by the York Company, a two by two and also tested a small household water cooled ammonia job.
Q. In connection with these investigations, or at any time, did you run upon an Isko air cooled machine in actual service?
A. They were at that time in Dayton to my knowledge, I could not say exactly how many, but several of the Isko jobs.
Q. And for how long did you know of them being in service, for what length of time?
A. I knew of two that were in service at least five or six years, and I think one of them is still in service at the present time, and what makes me think that, because Mr. Wells, who owned the job purchased another job and had this removed, and a relative, I think it was his father, came to me and got some tubing to reconnect the job up and told me about the job and I ran out and looked at the job.
Q. What kind of tubing did it and the other Isko have?
A. They had small copper tubing, its exact dimensions I could not say, ⅜ or not over half an inch.
Q. Now in connection with your development of refrigerating machinery, did you have to do particularly with condensing problems, I mean the problems of constructing the condenser?
A. Of course in research work we study all parts that make up the system, and made and tested out different types of condensers.
Q. How big, for example, in diameter, did you try condensers?
A. Up to—I would not want to say exactly, between five—four and five inches in diameter, a tube.
Q. A tube or cylinder four or five inches in diameter?
A. Yes, sir.
Q. And of what length?
A. Oh, the longest one I remember of is I would say two feet long.
The Court: You mean of the large size?
The Witness: Yes.
Q. And of what material?
A. They were of brass because it was hard to obtain copper of that dimension.
Q. Did you attempt to get scientific data bearing on the subject of proper dimensions for the condenser of the household job?
A. Well, as I say, when I started this research work, we all felt that it should be air cooled work for household work, or at the laboratories, that was Mr. Kettering's idea, and I tried to find that data in regard to air cooled condensers, in fact I got up practically all the handbooks and refrigeration I could get and I could find no information at all on air cooled condensers for refrigeration work.
The Court: This was at what time now?
The Witness: In 1918.
Q. What else did you do besides trying these four inch cylinders?
A. Well, on this four inch cylinder I want to add that we put a great amount of copper fins; those were soldered on to the tube and on the four or five inch cylinder I put fins on there of, I would say, from in the neighborhood of five eighths long—I filled it about as full of fins as it was practical to put on with 3-32 of an inch between the fins; that would vary with the diameter, but on the average I would say about 3-32 of an inch; that was my first try with that, and then I had a sleeve, and fairly tightly fitted to drive that air up through the fins, and I got very poor results from that, and I next took a double wall tube—
Q. That is two concentric tubes?
A. Two concentric tubes with a space of, as I remember, possibly ⅜ to a half inch between the two sleeves and I then added all that finning that I could get on the outside of the inner tube, giving me fins on both the outside of the outer tube and the inside of the inner tube, and with a sleeve around that, blowing air through that.
Q. And of what diameter was that outer tube?
A. That outer tube was practically the same in diameter as the original job with the one tube.
Q. That, is, about five inches or more?
A. Something in the neighborhood of four or five inches, I would not remember exactly the data on that.
Q. Then you went through other tests and trials?

J. G. King, Chief Refrigeration Engineer for Frigidaire, Testifies

A. Yes, sir. I then commenced to make a comparison of that with tubing—that is, tubing of smaller diameters.

Q. What decision did you finally come to as to which was the best?

A. The job we had then, a job we had figured on putting in production, and that job we were getting ready on for production, and making production drawings, after experimenting with different sizes and lengths of tubes we ended up with ⅜ inch copper tubing.

Q. What has been your experience with that since?

A. Well, we several times got away from the ⅜ inch or nearly ⅜ inch, and I always went back to ⅜, and my experience has been along this line, and we have used that more for our data than anything else, not discarding—Well, in fact I could get no other information, and that is about the conclusion we have come to, and from our vast amount of experience with condensers, that we use a ⅜ inch tube for condensers of in the neighborhood of a quarter horsepower capacity, which seems to give us the proper velocity of gas, to get the best heat transfer, and then as our jobs go up we use more of this same size tubing, and use it in in multiple so as to get back to the same velocity on larger sized jobs we have got in the single tube.

Q. Has velocity something to do with the condensing problems?

A. Well, our tests show that very plain.

Q. What is the average velocity of your operation?

A. Well, I would say the gas, when entering the tube possibly is around a thousand feet, and of course it goes down then, and at the condensing point it drops off to nothing, you might say?

The Court: A thousand feet in how long, per minute?

The Witness: Yes. Giving the average I would say around 500 cubic feet as an average.

Q. 500 lineal feet per minute?

A. Yes.

Q. It has been testified here, as I understood the testimony, that the surface area of the condenser is the principal if not the only criterion in respect of the condenser's function. What do you say about that?

A. Well, of course in air cooled work you are limited for household purposes in the amount of air that is permissible to use, so that is our experience with the ⅜ tube, using the amount of air that is permissible, because there is a condition, like a kitchen or home, that you cannot use all the air you want, because it sets up—as an illustration, blowing the air out of the back of the cabinet, and trying to use too much air you get objection on account of collecting dirt on the wall and blowing it to the front, it is objectionable, so there is a little amount of air that you can use, and also from the noise standpoint too, so we try to set about the amount of air and apportion a certain amount of air to our service, an amount that we think is an advantage to use, and always results in about a ⅜ tube giving the proper amount.

Q. My question was whether the surface area of the condenser would work the same irrespective of the form of the condenser, whether in a cylinder of the kind you first used or a copper tube of ⅜ inch size?

A. Well, as I say, our experience with large tubes did not give us the results it did with small tubes, because the large tube was—so much of the gas did not come in contact with the surface and made it very inefficient.

Q. Have you had any experience with this kind of condenser that has been put in evidence here, as the Flintlock?

A. Yes, sir.

Q. Just state what that experience has been with respect to the size of the bore in Plaintiff's exhibit 17.

A. Our experience checked on that, the same as it does with our other tubing.

Q. Did you have any experience with a size of bore or opening there that was materially different from ⅜?

A. Yes, we have.

Q. Just tell us about that?

A. Well our experience has been that when we go above, even in this Flintlock, when we go above that small size that our cost and weight go up considerable to get the same results, and of course that is what we are after, is results, regardless of anything else, I would say, and efficiency.

Q. What size opening in the Flintlock are you now purchasing?

A. Why on one job we have been using 7-16, and we have used some smaller, but in regard to the one we are using, 7-16, we have had one submitted to us which was partly through our suggestion, because we thought that 7-16 was not the proper size, and they have built us one now that is slightly under ⅜, and on which they have submitted the surprise of $3.00 less than the 7-16.

Q. Does that $3.00 mean per condensing unit?

A. Yes.

Q. Are you familiar generally with the household refrigerating apparatus put out by the competitors of your company?

A. We have made a study of this quite a great deal, yes sir, and while I have not actually tested all of them myself, I have had quite a few men on them, and I try to watch what the other fellow is doing and try to keep very close in touch with our competition.

Q. Do you know of any household air cooled ammonia refrigerating apparatus?

A. I do not.

Q. What order of power would be needed to cool or refrigerate a freight car of say 1500 to 1600 cubic feet contents?

A. Well, not going into the actual calculations I would say from three to five horsepower.

Q. And your range of household sizes is what?

A. We are building up to 1½ horsepower.

Q. What cubical contents would that be of the refrigerator box?

A. Well, that depends a little on the temperature you are trying to get. Without referring to our calculations I would say around four or five hundred cubic feet; that decrease depends on the shape of the box, we figure more from the actual service than cubical contents in this other stuff on account of the different shapes of boxes.

Q. And in that you are using the ⅜ copper condenser?

A. At the present time it is the 7-16—

Q. And that is to be changed to something just under ⅜?

A. Yes.

Q. 11-32, is it?

A. Yes, 11-32.

Picture of court room scene taken by Electric Refrigeration News.

The Court: If the photographer is all ready now, we will put him on and let him take the pictures.

(A flashlight picture was here taken.)

Q. (By Mr. Cooper, continuing:) According to your experience how high can you go with air cooling with the cases such as you have used?

A. Well, I have made the recommendation to our organization that we should not try to make anything larger than the job we have.

Q. And that is based on all your experience and investigation and actual tests in your laboratory?

A. Yes, sir.

Q. In the course of your business with the plaintiff, and these predecessors that you have had a connection with in the early days, you have come in contact with many refrigerating engineers?

A. Yes sir, when we put our ice cream cabinet on the market I made quite a number of contacts with the ice cream manufacturers, and they always called in their operating engineer and their engineer had an awful time preparing and selling them on the idea of air cooling.

Mr. Frye: Was that asked for, your Honor? We move it be stricken out.

Mr. Cooper: Well, I am going to ask him the question. What was their opinion?

The Witness: That air cooling was impracticable.

Mr. Frye: We object to that; how can he tell what their opinion was except by hearsay?

Mr. Cooper: Just the way your man stated.

The Court: I will let it stand.

Mr. Cooper: That is all.

Cross Examination

By Mr. Frye:

Q. What was the rate of flow or velocity of flow that you said you desired used in the condensers?

A. An average of about 500 lineal feet.

Q. And not to exceed 1000, is that the way it was?

A. Well, to get the best results, yes.

Q. That is 1000 feet per minute?

A. Yes.

Q. Now, I call your attention to the Martin & Beath patent, re-issue number 4992 at the bottom of page 3.

Mr. Cooper: I don't think, if your Honor please, this is admissible. Counsel can read what he wants from it, it is in evidence, but the witness is not called about patents.

The Court: Objection over-ruled.

Q. I ask you if you find this statement: "Therefore the aggregate sectional areas of pipes in either congealer or condenser should be sufficient to convey the gas or vapor at a velocity not exceeding 16 feet per second in any point of its course."

Mr. Cooper: I will concede that appears in the patent.

Q. Now how many feet per minute is 16 feet per second.

The Court: 960.

Mr. Cooper: I will concede that. Go on with something else.

Q. 960 feet per minute. Is that so?

A. I made my statement and I want it to hold as I made my testimony.

Q. Did you ever examine the Martin & Beath patent?

A. I did not.

Q. You never thought of that as a source of information for these various tests?

A. I paid very little attention to that as far as getting information, that is the patent department's business.

Q. Now, what prior machines did you test, what prior machines made prior to your 1908 test did you actually test?

A. In air or water?

Q. Of course I am asking you generally.

A. I tested the Kelvinator, I tested the Guardian water cooled. I tested a small ammonia job that had been built by the Dayton Mill Products Company.

Q. Air cooled or water cooled?

A. Water cooled.

Q. Go ahead.

A. In fact, I tested about all I was able to get hold of; they were very hard to get, air cooled jobs in 1918.

Q. You have mentioned the Kelvinator. Was that an air cooled job?

A. Yes sir.

Q. And what size copper tubes were used in this condenser if you know?

A. Not over half inch.

Q. Was it or was it not three eighths inch copper tubes or do you know?

A. I would say it was half an inch.

Q. And this is in 1918?

A. Yes, sir.

Q. Now, did you test any other air cooled condensers during these tests made by competitors?

A. In 1918?

Q. Or the following years, I don't remember the duration of your tests?

A. Well, I don't know in 1918 of any companies to any extent making air cooled condensers.

Q. Well, that is not the question?

A. No I did not, in 1918 it is—

Q. How about in 1919.

A. Or 1919.

Q. Or 1920. When was it you began testing air cooled condensers of competitors if you did?

A. I would say to my best knowledge around 1921 or 1922.

Q. Now can you remember what makes they were?

A. I think it was Servel, I think around in 1922, I would not want to be sure on those dates, but I think it was 1922 when I tested Servel.

Q. I am speaking of the period you were making your tests, I think it was from 1918 on—

A. From 1918, my 1918 work was tests of the stuff we built ourselves.

Q. How long did you continue these tests, right up to the present day?

A. I did not individually test them, but I have men in my department testing right along, yes sir.

Q. When was it your company came on the market with an air cooled one?

A. It actually went on the market about 1923, I think.

Q. And did they build the machine on your recommendation?

A. At that time Mr. Hull, who was with me, followed that up more than I did, because we still had the water cooled job in production, and I was following that closer than—what Mr. Hull had gone through with me on these tests, joined me in about December 1919, I believe.

The Court: I don't just remember what time you said you settled on ⅜ or ½ inch.

The Witness: About 1921.

The Court: I am sorry to have interrupted you.

The Witness: But we did not get into production at that time.

Q. When did you go into production? —When you did get into production it was on the machine that was recommended by you as a result of your experiments?

A. Well, Mr. Hull made the decisions, I was not following it at that time.

Q. Well, you recommended what size the condenser should be, ⅜ inch, and not to exceed ½ inch?

A. I have always recommended since my tests along about 1921 ⅜ inch or thereabouts, but my recommendations do not always—because I was not in full charge at that time.

Q. Well, did you make any recommendations or merely report to your officials, or what did you do?

A. I made recommendations of ⅜, yes.

Q. Did they take them?

A. Not at first, no.

Q. What size did they make?

A. A quarter inch.

Q. When did they get into the ⅜ or ½ inch, or whatever it was you recommended?

A. Mr. Hull was put on other work, and then I took active charge of that job, and as soon as I took active charge of the job I put on ⅜.

Q. When was that, I said?

A. I would not be sure of exactly the date, but maybe six months, probably six months to a year or a year and a half after we went into production.

Q. During the time of testing from 1918 to 1923, somewhere in there, did you examine any patents to learn about the sizes to make?

A. I did not.

The Court: You did not examine Wolf or any of them?

The Witness: I did not.

The Court: When was it you first recommended ⅜ and reached the conclusion it was the proper size.

The Witness: Well, we had built an experimental machine; you see, which we were going to recommend for production; that was at the research laboratory, you see, and then the water cooled job built in Detroit by the Frigidaire Corporation, moved down to Dayton, and that held up our going into production on the job we intended to go into production on, and later on then they went into production with an air cooled job. We built up six of those jobs.

The Court: Your company did not own the Wolf patent then?

The Witness: Not to my recollection, no sir.

The Court: It did not have anything to do with your line of reasoning?

The Witness: Absolutely not, no sir. I have never read the Wolf patent.

Q. How long have you personally been acquainted with ⅜ inch copper tubing?

A. Well, I have been acquainted with copper tubing for—in my work in connection with automobile work.

Q. Has it been 25 years or 20 years or—

A. Well, I will have to figure a little bit. I would say 20 years.

Q. Did you ever know of a machine shop or any shop of that kind where you worked where copper tubing of comparatively small diameters like ¼ and ⅜ inch was not all around the shop, so to speak, that you had it available like one witness expressed it, like wire nails?

A. No, because my experience in factories was not of the type of factories that used copper tubing. With the Westinghouse company I was in the engineering department.

Q. You were not in the manufacturing department then, is that right?

A. No, I was in the engineering department, I was in the practical department of the National Cash Register Company, and I did not know of any there either.

Q. How about the stock room of the Westinghouse Company, don't you think you would find it there?

A. I was a transformer designer, and we did not use any copper tubing on transformers, and I had no occasion to go to the stock room of the Westinghouse Company.

Q. I never knew of a copper tube on a transformer either, that is another example. How about the automobile industry?

A. That is when I first came in contact with some copper tubing for oil and gasoline lines.

Q. How about condensers?

A. Well, I had nothing particularly to do with the condensers, I didn't pay much attention, because I was in the lighting end of it, started in the lighting end of it and I didn't pay much attention to anything but the electrical end, but working around the car I did see copper tubing for oil and gasoline lines.

Q. Were you ever in the condenser plant of the Westinghouse Company at South Philadelphia?

A. I was not.

Q. Now, among the several tests on competitors' machines that you say you have made, let me ask you if you have ever made one on the Frigidor machine?

A. There has been so many of them, I can—I recall the name, but I don't recall making a test on the job.

Q. Do you know if they made a household refrigerator ahead of 1918?

A. No, I do not.

Q. How about the North pole Refrigerating Machine? Did you test that one?

A. I did not.

Q. Did you know of there being an air cooled household refrigerator on the market?

A. I do not.

Q. I believe you have stated that you tested the Isko machine?

A. The Isko water machine.

Q. Not the Isko air cooled?

A. Not actually tested, no sir.

Q. How about the Domelre air cooled machine?

A. I did not actually test it.

Mr. Cooper: Did you know about it?

The Witness: I knew of it, yes.

Q. You know of the Beath, Isko and Domelre?

A. Yes.

Q. Did you know of the Freezerator, I believe you mentioned that before?

A. Yes sir, a three cylinder job, one I tested.

Q. How about the Fridger, did you test that machine?

A. Who was the manufacturer of that machine?

Q. It was manufactured in Chicago, it says Wells Street.

A. I did.

Q. You tested that one, the Fridger?

A. Yes, sir.

Q. About what year was that?

A. That was either 1918 or 1919.

Q. I hand you what purports to be a circular advertising the Fridger Machine, and ask you if that was the machine you tested?

A. No, sir.

Q. What is that one there, water cooled or air cooled, if you know?

A. It doesn't show any water connection.

Q. So you surmise it is air cooled, is that the idea?

Mr. Cooper: I will object to that. That calls for a conclusion.

Mr. Frye: Well, I have asked him if he can tell. He says he cannot say it is water. Now, what is it?

A. I cannot say that it is air.

Mr. Cooper: There, you have it.

Mr. Frye: We desire to have this particular card marked exhibit 46 for identification.

(Card referred to was marked "Exhibit 46" for identification.)

Q. Now, you did mention the Kelvinator, didn't you?

A. Yes, sir.

Q. Did you ever hear of the Kofax?

A. The Kofax?

Q. Yes.

A. I could not swear that I ever heard of it.

Q. What is that?

A. I could not swear that I ever heard of it.

Q. You do not happen to know that that machine was put out by Fred W. Wolf, of Chicago?

A. I do not.

Q. Well now, when it comes right down it, you cannot remember having tested many air cooled machines at all, can you?

A. Not prior of 1921 or 1922, no.

Q. Let me ask you, Mr. King; do you think that your tests or discoveries tend to create any new principles of heat transfer, or anything of that nature?

Mr. Cooper: I think that calls for a conclusion, if your Honor please—

Mr. Frye: I am wondering—

Mr. Cooper: No, I am addressing the Court on an objection. I think that calls for a conclusion, your Honor, and that is not an admissible question.

The Court: Overruled.

A. I discovered certain relations to surfaces and gas speeds. They were new to me.

Q. Did you try to obtain letters patent on any of these discoveries.

Mr. Cooper: I will object to that, if your Honor please. That cannot be opened, the question.

The Court: Overruled.

A. Well, personally I never tried to get any kind of patents. The patent department follows my work.

Q. Have you signed any applications for letters patent on your development work there?

A. Well, on this job that had the ⅜ inch tube, I signed patent applications, but what the specific claims were, I do not remember.

Q. When did you file this, in 1922 or 1923 or thereabouts?

A. The date when that was filed, I could not say.

Q. Well now, let me be sure that we understand each other: Do you contend there is any change, at this relatively late date, in the principles of heat transfer?

Mr. Cooper: If your Honor please, this gentleman is not a contender at all. He was asked to state facts, and I do not think the form of the question is a proper one. If counsel wants to elicit facts, I have no objection.

Mr. Frye: I want the facts, of course.

Mr. Cooper: I do not think it is a question of contending.

Mr. Frye: Let's eliminate that word, "Contend," We have no desire of contentions or anything of that nature.

Q. You have stated, however, that you think your discoveries tend to create new facts, we will put it that way. Now, will you explain, if possible, what new facts you have added to the well known principles of heat transfer which are to be found in text books and various sources of information.

Mr. Cooper: I think that counsel is misrepresenting the witness. I did not hear any representations or claims as to having made discoveries.

The Court: I understand his answer to be—about the way I interpreted his answer, I may not be quoting him exactly right—I don't think he is attempting to say that he discovered anything that was not known to other people before. Maybe I did not hear him right.

The Witness: Your Honor, that is the way I intended it.

Q. What is the largest refrigerating machine manufactured by your company, if you know?

A. In horsepower, 1½.

Q. How about in capacity, that is cubic feet, or whatever way you talk about that?

A. Well, that depends—B. T. U.'s, you mean?

Q. No, I mean like you say it is a seven foot box; how many cubic feet would that represent?

A. Well, that would be according to the tension you were trying to get in that box.

Q. I will admit I do not know enough to ask you the question. I would like you to explain to the Court what you can use this large one for.

Mr. Cooper: Can you figure it by tonnage of melted ice? That is the way one witness has done.

A. We rate that machine around 500 pounds on a 12 hour basis, running 12 hours out of 24.

Q. Is it 1000 pounds on a 24 hours day, is that it?

A. And depending, on, as I say, upon what tension you are trying to obtain in the box.

Q. What size condenser tubes are used in that particular job?

A. That particular job is the one that has the 7-16 that I referred to.

Q. 7-16?

A. Yes, and we are expecting to cut that down, because—as I said in a statement a bit ago.

Q. 7-16 what? I do not quite understand that?

A. Well, it is about 7-16 O. D.—outside diameter tubing.

Mr. Frye: That is all.

Redirect Examination

By Mr. Cooper:

Q. How many different sizes of copper tubing—by that I mean diameter—have you known over this period of 20 years? It was not confined to the ⅜ was it?

A. Oh, no.

Q. Everything from a quarter or 1-8 inch up to one half inch?

A. Yes.

Mr. Cooper: That is all.

The Court: How was it you got down to the ⅜ inch? How did you arrive at it?

The Witness: I don't know whether you want this to go on the record—I am one of those Coldberg engineers—I try until I find out which is the best.

The Court: How did you get at it to find out?

The Witness: Well, in checking our condensing pressures, as our condensing pressures go up we know our power consumption is going up, and we aim to establish a condensing pressure relative to the room temperature, and there is an economical pressure there that we strive for in relation to the room temperature.

The Court: What I wondered was, whether you figured out mathematically and mechanically, or by trying different methods.

The Witness: Most of my work is actually trying it and finding out results.

The Court: But you need no assistance, as I understand it, from the Wolf patent or any other patent?

The Witness: No, air.

The Court: You went at it alone?

The Witness: Yes, I did.

Recross Examination

By Mr. Frye:

Q. Did you mention what refrigerant you used in these tests?

A. Most of our work has been SO2. I have run some other refrigerants. When we first started in our research work in 1918, we investigated several different kinds of refrigerants; but in comparative tests in our condenser work, it has been practically all SO2, especially my own individual work, because I have always been sold on SO2 as a refrigerant.

Q. Did you find any special relation between that and the air cooled condenser?

A. Yes, sir.

Q. What is it?

A. Well, first I tried some ammonia work.

Q. Without going into the long tale about ammonia, let's concentrate on what you found about SO2 and air cooling. I think we can save time?

A. My experience has been that you have got to watch your temperatures on your compressor, and when you go into the ammonia work with higher condensing pressures, you get—especially if you are interested in air cooled stuff—you get too high a temperature on the cylinders of your compressor.

Q. You think it is the cooling of the compressor, not condenser, that the SO2 is useful in?

A. No, no, you have got to take the system as a whole.

Q. I must have misunderstood you then. Will you repeat that? You say you figure compressor temperatures, or condenser?

A. No, I did not say I figured—I say we watch our compressor temperatures as well as our condenser temperatures.

Q. The relation of SO2 and air cooling, so-called air cooling compressor, you are talking about now, or the condenser?

A. I don't get what you are driving at.

Q. And I don't get what you are driving at. Let's get together?

A. Can you put it so I can say yes or no?

Q. No, that is a leading question. We cannot do that.

Mr. Cooper: You are cross examining the witness. I will let you go as far as you like.

Q. You have said that there was a special relationship found by you between air cooling and SO2 as a refrigerant. Now, I want you to state what that is, if you can.

A. Well, I would not say that there is any particular relationship of SO2 alone. It is any of those refrigerants that you do not have to put under high condensing pressure.

Q. For instance, would that apply equally or better to ethyl chloride than it would to SO2?

Mr. Cooper: Are you speaking of ethyl or methyl chloride?

Mr. Frye: ethyl.

A. Oh, I don't think so, because there is not much difference, a great amount of difference, not enough so you could prepare that, or practically as much surface, there is not so much difference that I can see.

Q. How about pressures?

A. It is some higher—ethyl?

Q. Ethyl.

A. Oh, ethyl is away down the line.

Q. Is there any better relation between air and ethyl chloride than between air and ethyl too?

A. My experience with ethyl chloride has been so rotten that I did not have any more to do with it.

Q. What was that experience?

A. A machine.

Q. One machine?

A. Yes, sir.

Q. And that is all?

A. Yes, sir.

Q. Now, was it recently or a long time ago?

A. Well, it is some time ago.

Q. About when, before 1918, or subsequently?

A. After 1918.

Q. Let's put it this way: Is it the reduction of pressures in your condenser that you are striving for in connection with SO2?

A. I do not get what you mean.

Q. Low condenser pressures, is that what you are seeking when you use SO2 as a refrigerant?

A. Not exactly.

Q. What is it that you are getting—

A. I think within a certain range there, I think condensing pressures are desirable for household purposes.

Q. Low condensing pressures?

A. Providing you do not have to get too low on the vacuum side.

Q. The condensing pressures I am talking about, Mr. King?

A. Yes, sir.

Q. You certainly understand, don't you —there is no vacuum there?

A. Well, as a rule—

Q. Are you sure you understand what we are talking about?

A. No, I am not sure.

Q. Then I would prefer you to say when you do not understand—because I did not think you did, there: Now you have stated this special relationship. So far as I have been able to find to date, you say it is some low pressure. Now, is it the low pressure in the condenser?

A. I have not made any statement of what I consider low pressures.

Q. Well then, let's make it. What do you consider low pressures?

A. Desirable pressure for household pressures, which I think should range from, say, 60 to 125 pounds, bringing the refrigerant along in that range from air cooling, 60 to 125 pounds. Different refrigerants will come within that range.

Q. Why do you stop at 125 pounds?

A. Why do I stop at 125 pounds?

Q. Yes, why?

A. Well, partly from the compressor condition, and for air cooling purposes.

Q. What part of your machine won't stand a pressure of 125 pounds, if any?

A. There is no part of our machine that will not stand a pressure of 125 pounds.

Q. What part of your machine won't withstand quite 125 pounds?

A. No part of our machine won't withstand it.

Q. Then it cannot be the resistance offered by the machine, then, as the reason—

A. I told you on account of the compressor conditions, temperature of the compressor for air cooling purposes.

Q. Air cooling the compressor—isn't that what you said? Let's get down to what you mean: Is it air cooling the compressor or the condenser?

A. I do not think a person would use water cooling on the compression, then use air cooling on the condenser.

Q. But now, we are talking of some special relationship that you discovered. I am trying to have you state that special relationship.

A. There is a relationship between your temperatures on your condenser and your compressor, yes.

Q. What is it?

A. When you go into this higher gas that goes to higher pressures, you get higher pressure on that compressor.

Q. That certainly is not new, is it?

Plaintiff's Expert Reviews Patents Offered by Defendant

A. No, I didn't say there was anything new about that.

Q. What was the new feature you discovered.

Mr. Cooper: He has stated that a dozen times. I don't think he should be harried.

A. I did not claim that I discovered anything. I found what I thought would work out best, in my actual tests.

Q. You have told something about this not exceeding 125 pounds. Now, about the lower range, why don't you want it to go below 60 pounds?

A. I didn't say I didn't want it to go below 60 pounds, because I don't know of any refrigerants that I think are good refrigerants, that your temperatures, compressing pressures, condensing pressures, would be below that, 60.

Q. At what temperature?

A. Well, the conditions you run into in the ordinary home or kitchen.

Q. Well, would that be, we will say, between 70 and 80 degrees Fahrenheit?

A. Well, the kitchens get hotter than 80 degrees, yes.

Q. I want your opinion as to what you mean by temperatures of a kitchen: would you say within a range of 10 degrees, is that what you have in mind?

A. Within 10 degrees?

Q. Yes, I would say 70 to 80—would you say?

A. Well, I agree with you on that point.

Q. And you say that no successful refrigerant, if I understand you correctly, for household purposes add those temperatures, has a pressure relationship of over 60 pounds.

Mr. Cooper: If your honor please, counsel, if he wants to quote what the witness says, should quote him—the witness said nothing of that sort that I heard.

Mr. Frye: Well, what does he say about this under 60 degrees? Let's us express that once.

Mr. Cooper: Degrees or pounds?

Q. Sixty pound pressure at between 70 and 80 degrees, now as I understand it; correct me if I am wrong; you say that none of the refrigerants that are successful can be used at lower than 60—

A. I did not say they could not be used.

Q. What did you say?

A. In my opinion, I said that I did not think that the refrigerants below those condensing pressures, were the type of refrigerants used for household purposes.

Q. Well, what is the reason for that opinion? Is it safety or something of that kind? Have you any particular reason that you want to state in the record—let us put it that way?

A. I don't know what you are trying to get out of me.

Q. Well, you said that is your opinion. You must have some reason?

A. I said that those refrigerants that I thought were the right refrigerants for household purposes came within those ranges. Now, I don't know how else to state it.

Q. You have negatively, at least, said that the ones that did not come in are not successful for household use, haven't you?

A. I did not say that they were not successful. I said in my opinion I would not pick those refrigerants.

The Court: Well, why—is the question.

Q. Why wouldn't you pick those refrigerants?

A. Do you want me to take ammonia first, because it is a high one.

Q. We are talking below 60?

A. I said I would put a range—do you want to take—

Q. Let's begin at this 60.

A. To my knowledge, that would possibly take you into the ethyl chloride. That is the only one I know of.

Q. Yes, that is a good example?

A. And you have got to run such an awful vacuum, and if you want to get any kind of temperatures, your gas is so rare that your refrigeration is very inefficient.

Q. When you are talking 60 pound pressure at condenser, what would be your vacuum on the low side, as an engineer?

A. Vacuum on the low side?

Q. Yes; you don't have a vacuum on your compressor side; it is on the low side?

A. Isn't part of the compressor on the low side?

Q. I did not think so?

A. You didn't?

Q. I am talking of condenser pressures. Are you?

A. The condenser is not on the low side, no.

Q. Where 60 pounds condenser pressure—

A. Yes.

Q. You said there is a low vacuum. What would be the vacuum on the low side, or pressure, if it is a pressure, that corresponds with the 60 pound condenser pressure on the high side?

A. I know of no refrigerant that would run at 60 pounds in the ordinary kitchen, just at 60 pounds.

Q. Well, I am speaking of below 60?

A. We will take ethyl chloride, the chances are it will run about 20 pounds condensing pressure.

Q. What would be your vacuum?

A. The chances are it would be around 18, 19 inches.

Q. Do you know?

A. I tested a machine, yes.

Q. What was the vacuum in that?

A. It was around 18 inches, that particular construction of machine.

Q. Who made this machine?

A. Mr. Wolf made this machine.

Q. What was the name of that machine, if you know? Let me ask this: Did it ever reach the market?

A. There were some put out, I do not know to what extent.

Q. When was it put out?

A. Around 1918.

Q. Now, about the others? You said that ethyl chloride needed too low a vacuum?

A. The rest of them I did not run tests.

The Court: Which is the ethyl?

Mr. Frye: Ethyl is the one that the gentleman this morning, Mr. Palmer, told about such long use of.

The Court: When he speaks about ethyl, is he also talking about methyl?

The Witness: No, sir; no, sir.

Mr. Frye: Oh, no, methyl is an entirely different one.

The Court: Ethyl is the one made out of the grain alcohol?

Mr. Frye: Yes.

Q. Now, have you made any tests with methyl chloride?

A. Methyl?

Q. Yes, not ethyl.

A. I ran some tests with methyl, yes.

Q. What did you find its relationship relative to SO2? Were they interchangeable, or one tested better than the other?

A. Well, you could run the same refrigerant in either machine.

Q. Would it require any changes?

A. Well, that would depend upon how close you designed your capacity up to a given motor. If you designed your capacity on an SO2 machine to a given motor, clear up to the capacity of the motor driving at the same speed, you might possibly overload the motor.

Q. With what? With methyl? You would overload it if you changed to methyl, you mean?

A. I mean if the machine was clear up to the capacity of a quarter horse power motor, driving at the same speed.

The Court: Ethyl takes more compression?

The Witness: The higher compression gas, yes.

Q. Well, now, when we figure to take a certain amount of heat, as I understand you, say on a refrigerated area like a room or an ice box, would you have to change the capacity of the motor for those two refrigerants?

A. Well, I understand—

Q. You see what I mean: Take a seven-foot box, that is the capacity?

A. No, not necessarily, because you put on one-quarter horse power types all the way from 6, 7, 8, 9 foot boxes; you don't put a box—

Q. Well, suppose we have a box, I don't care if it is seven feet or seventy, but just take that as an example?

The Court: Exhibit 9?

Mr. Frye: Yes, exhibit 9 is one I had in mind.

Q. Using SO2 in that exhibit, what would be necessary to change it to methyl chloride, if anything?

A. I do not believe you have got my answers, to capacity—

Q. Never mind your answers. Let's answer this one. I am talking about taking up the same amount of heat; regardless of where it comes from. I am talking about size and capacity of heat absorption. Now, can you answer that question?

A. Not the way you put it.

Mr. Cooper: I don't think anybody could. Why don't you ask him if he could use methyl chloride in that box?

Q. Why cannot you answer that question?

A. Because you have not stated it in an engineering way.

Q. Well, let's try it this way: We want to absorb or take up the same reviews of heat with two refrigerants, one of them SO2, the other methyl chloride: What has to be done in the machine?

A. In what length of time are you going to take it up, the same length of time?

Q. The same time, the same capacity or same amount of—same amount of heat. Now, that ought to be equal, I asked you—

A. Well, if you were using the other refrigerant, if ethyl chloride was the other refrigerant, and you were driving at the same speed and the same compressor, it would not take up the same heat in the same amount of time—

Q. Please answer the question, or say whether you can or can not.

A. You have not stated it in an engineering way.

Q. Can you answer this: We want to absorb a certain amount of heat in a certain length of time. Now, we want to do it with two refrigerants, first SO2 and second methyl chloride: What needs to be done about the machines in order to get that result in both cases? Is that clear? If I am not, I will put in whatever factor is omitted, I hope it is clear?

A. It all depends upon how near you come up to the capacity of your motor in your SO2 job.

Q. Well, you say the motor: is there a difference in power between the two refrigerants, that you are going to require more motive power in one than in the other?

A. If you have got the same displacement in a machine that has got SO2 and methyl chloride, it takes more power to drive one with the methyl chloride; if you have got the same displacement.

Q. What do you mean by displacement, compressor?

A. Yes.

Q. Well, now suppose we have the same compressor in the two machines: you are substituting refrigerants only: according to your idea, it will require a bigger motor in methyl chloride?

A. If you have got the same displacement in your compressor.

Q. That is what I say; that means the same speed, same sizes, doesn't it?

A. Same displacement per minute.

Q. And the idea is, as you bring it out, that methyl chloride requires the bigger motor, is that right? I want it in every day language, and if I am a little wrong on that, correct me; but is or isn't that the fact?

A. I said if you had the same displacement per minute, you could need a larger motor for methyl chloride than for SO2. Now, that is the only way I can state it in engineering language.

Q. Well, won't you at the same time take up more heat in your refrigerated area?

A. If you have got the same displacement?

Q. Yes.

A. And you use the methyl chloride, with the same displacement, you take up more heat in a given time.

Q. You do?

A. Yes.

Q. Well, now that is what I have been wanting you to say.

Re-Direct Examination

By Mr. Cooper:

Q. That would require faster operation of your motor, wouldn't it?

A. The same displacement per minute?

Q. Yes.

A. The amount of cubic feet of gas an inch—see, if you are trying to get the same temperature, same surface of expansion—

Q. You were interrupted, I think, when you were stating some connection between the cooling of the compressor and the cooling of the condenser. Will you state what the facts are about that? How your compressor is cooled in these jobs like the refrigerator here in court. Are they cooled the same time that your condenser is?

A. We always pull the heat out, that is made by the compressor as well as the condenser.

Q. Yes?

A. Yes.

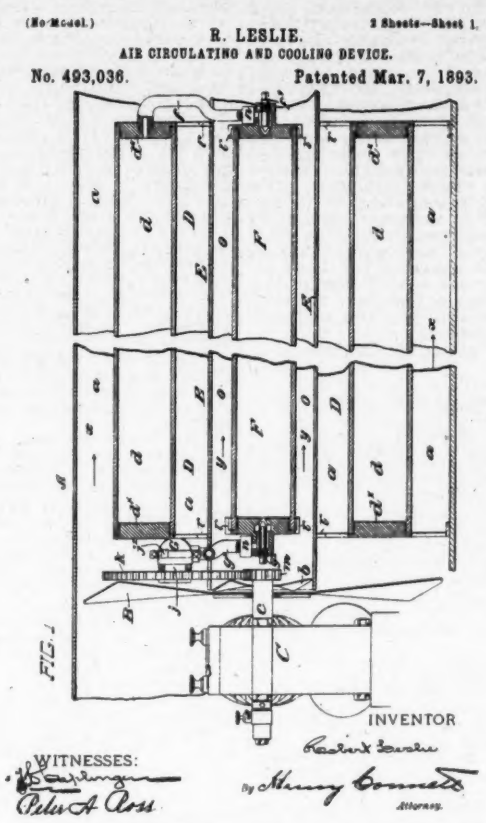
Q. I suppose the condenser itself is all the time drawing from the compressor, isn't it?

A. Well, it is helping to heat that compartment.

Mr. Cooper: That is all.

(Whereupon recess taken until 1:30 p. m.)

THE LESLIE PATENT



One of the diagrams from Patent No. 493,036 issued to R. Leslie, March 7, 1893

AFTERNOON SESSION

Friday, March 22, 1929.
1:30 o'clock P. M.

Court convened pursuant to recess.

Frank L. Sessions was thereup recalled as a witness on behalf of the plaintiff, having been previously duly sworn, testified as follows:

Direct Examination

By Mr. Cooper:

Q. I will ask you to take up for discussion and comparison with the invention set forth in the claims of the Wolf patent in suit, the five asserted by the defendant's witness, Mr. Van Deventer, to be the basis of the prior art, and to constitute complete anticipation, and those five are the Palmer Patent 716091, Martin and Beath Re-issue 4992, Leslie 493036, Johnson 328784, and Audiffren 898400. In connection with the last named patent you might also look at the Audiffren British patent, which was discussed in connection with a United States patent of the same name, Audiffren French patent 372886, and also French patent to Fascio, which Mr. VanDeventer also discussed in that connection.

Mr. Frye: At this point I would like the record to show where Mr. VanDeventer read a French patent 372 something, that he showed a picture of an addition to that patent which has the number 8405, and they quite often identify French patents by additions as well as the other patent, and to be certain there is no misunderstanding I turned over to one of the counsel for the defense the copy itself that Mr. VanDeventer used, and I don't care how it is identified so long as we are sure it is identified.

Mr. Cooper: Well, we have the original exhibit, which is the one to which his attention was directed.

Mr. Frye: Well, one way of identifying it is in the addition and the other the main patent, and if both are in we will be sure.

A. Taking up these patents that Mr. VanDeventer held as being anticipations to a greater or less degree, in the same order in which he discussed them, the first is United States patent 716091 to Palmer.

Frank L. Sessions reviews Palmer patent No. 716,091.

The title of this patent is "Auxiliary power device for cars." It shows a compressor, P, for refrigerating apparatus and condenser coil; small B, located in compartment large B, the refrigerating coil large L. It also shows a speed changing device which is enclosed in a compartment, large D, and the object of the invention as stated on page 1 commencing with line 32 is: "The object of my invention is to so protect certain portions or all of the auxiliary mechanism that the dust will be kept out of the same as far as is possible."

To effect this exclusion of the dust he provides a fan, large C, which is piped by the duct, large F, to the interior of the compartment, large D, so as to create a pressure within the compartment, large D, and thereby exclude the dust. The fan, large C, is also used, as the specification states on page 1, line 96, for causing a circulation of air over the pipes, small B, from the condenser so as to cool the refrigerating liquid after it has passed through the pump. The pipes, small B, are not described, and while it is true that the fan C is said to be used for causing a circulation of air over the pipes small b, the same construction might be used for the pipes, small b, if they were covered with canvas that was kept moist, or if water were dripped upon the pipes. The construction as shown in the patent drawings is inoperative. The inlet fan is seen in figure 1, just to the left of the character or reference numeral large C, is at the periphery of the fan, and the outlet from the fan as shown in figure 2 is also at the periphery, consequently there would be a balanced condition of air suction for such a long circulation of air over the pipes.

As to the funnels, large K, there is nothing in the drawings to show how they are connected, except that one of them has a passage, small K, that leads to the inlet of the fan. That passage, small K, from the showing of the figure really appears to extend clear across the width of the car, as the axle or shaft of the fan C-2 is shown in full lines, and also the pipes leading to the cooling coil, large L.

In my opinion this patent is not a sufficient disclosure to enable me, as an engineer, to design a condenser for the apparatus shown in this patent, and consequently not such as to enable me to design one for a house refrigerator.

This Palmer patent shows an ordinary refrigerator car freight car size, apparently, a standard coach railway car, and it suggests nothing in the way of instructions to one who wishes to design a household refrigerator, which might be kept in an ordinary kitchen.

Witness discounts claim of Defense that Martin & Beath patent anticipates that of Wolf.

The next patent mentioned by Mr. VanDeventer is re-issue number 4992, to Martin & Beath for improvement in ice machines.

Aside from discussing principles of refrigeration, the drawings and description of this patent are extremely out of proportion, at least it would appear so from our present day knowledge of ice machinery.

In this patent, the main thing in which Mr. Van Deventer seemed to be interested, was the condenser, which is in the receptacle L. This receptacle is mounted into a vertical shaft C, which is hollow, for conducting water from the bottom of the tank up to nozzles (p) that are connected to pipes leading into the vertical shaft. The shaft has also a fan at its top for drawing air through openings M in the wall of the receptacle L, when the shaft of the fan is rotating. The specification states that the water is charged into this vertical shaft, and then on page 3, commencing about a third of the way down the first column, it says: "This shaft is revolved with sufficient velocity to force the water with which it is charged out of the hollow arm which descends in the form of spray over the coils of pipe G, while the propeller Q draws the air in through the side openings M, and forces it in a gentle current out at the contracted top of the casing."

The water therefore forms an important, if not the most important, part of the cooling medium for this condenser. The water falls upon the pipes G and is evaporated by the air currents produced by the propeller Q.

Your Honor is doubtless familiar with the method of determining the direction of wind that sailors and farmers have, of wetting the finger and turning it up and twisting it. When it is presented so that the wind evaporates the saliva on the finger, the finger feels cold. You hold your finger in the air without wetting it and all sides feel the same temperature.

The same principle is involved in what is known as the atmospherically cooled condensers, where water is sprayed up on the outside of the pipes, the latent heat of evaporation of water is very high, and in order for the water to be evaporated it abstracts heat from the surface on which it is located, cools off, takes the heat away from the pipe, so that it is not an air cooled condenser except that air in combination with water is meant.

Q. The only way of getting the water up through that hollow spindle C, on which the fan and sprinkler are mounted is by rotating it rapidly—there is no force shown to drive the water up, is there?

A. It is only by the rotation of the shaft rapidly that the water will be drawn out. There is a check valve in the bottom of the hollow shaft called for in the specification, and the shaft being charged, or as we used to say in the country when the pump failed to operate we primed it by pouring water down until the foot valve was covered sufficiently to hold the water as we operated the pump. This has to be primed to start.

If there be sufficient water in the receptacle L, it will stand at a level which will immerse or submerge the receiver I, and thereby, there would be direct cooling of the receiver I, by the water in the receptacle L.

Q. Now, how much water would have to go up that pipe, assuming that this was, as stated, near the bottom of the first column of page 3, if this refrigerant were ammonia, how much water would have to go up that pipe?

A. In which column?

Q. The first column of page 3, about three fourths down it says, "At present we prefer this fluid to be ammonia, and so forth."

A. The patent gives an example of the capacity of machines of this type. On page 4, the third full paragraph from the top, in the left hand column, it reads: "For machines of large size, which may be made of the capacity of ten tons per hour, it is required to make usually each freezing plate several hundred feet in length, using two or three sizes in each channel, placing the largest size at the outlet.

Now, ten tons per hour meams 240 tons per day and Mr. Hayes, in his testimony, stated that for a plant, as I recall it, freezing 200 tons of ice per day, a 50 horsepower motor would be required to supply the water to the atmospherically cooled condenser. If that be true, this plant described in this patent to Martin & Beath, having a capacity of 10 tons per hour, or 240 tons per day, would have to be served with a 50 horsepower motor to supply the water to the condenser.

Q. Is any motor whatever shown in this patent for driving the compressor or driving this large capacity water pump?

A. No.

Q. On the other branch of my original question, what relation do you regard this Martin & Beath patent to have to the invention of Wolf, as you have discussed it?

A. I think it would aid no one in the development, design or invention of such a machine as Wolf disclosed in his patent number 1337175.

Criticism of Leslie patent No. 493,036 on air circulating and cooling device.

The next patent that Mr. VanDeventer discussed, 493036, to Leslie, for air circulating and cooling device: I understood Mr. VanDeventer to state that there were two or more cylinders. (d) that served as the refrigerating portions of the device. As a matter of fact (d) is an annular space between two cylinders.

On page 1 of the specifications, commencing with line 42, we read this:

"Within the casing A, is mounted a receptacle D, formed of two cylinders of different diameters, arranged one within the other, and forming an annular chamber D, which I call the expansion chamber."

I wish to call attention to this because the condenser F, has only from 1-20 to 1-15 the capacity or volume of the cooling chamber, (d.) This patent is specifically for the cooling of air. It is stated in the first paragraph on the first page, commencing with line 8; reading as follows:

"My invention relates to that class of devices adapted for supplying cooled air to a room or office, and the object is to provide a portable apparatus which will cause a current of air to flow into the room or place to be cooled or ventilated, and in its passage flowing through a cooling or refrigerating device which will take up more or less of its heat."

On line 66 of the first page, we read: "I propose to employ any of the well known gases or chemicals which may be compressed and will produce intense cold by its expansion. Of these, carbonic acid and ammonia will serve the purpose."

The specification nowhere speaks of liquefying the refrigerant, merely compressing it, and, as has been brought out in this hearing, the use of ammonia and carbonic acid involve very high pressures to compress them so that they may be liquefied.

The Court: I suppose you increase the temperature of the gas before you liquefy?

The Witness: Yes, increase the temperature of the gas and then reduce it to liquefy it.

The Court: Well, I say, there is a wide range of gas through which it can be compressed before it liquefies, isn't that so, all of these?

The Witness: Yes, yes.

The Court: But as you do compress, even before you reach the liquid state, you are continually increasing the temperature?

The Witness: Yes, very rapidly.

A. (Continuing) There is nothing in this patent to help an engineer or one desiring to develop a household refrigerating apparatus, anything that would enable him to produce the machine of the Wolf patent in suit.

Witness insists Johnson patent No. 328,784 would be of no help in designing a domestic machine.

The next patent in the order in which they were taken up by the defendant is number 328784 for refrigerating and dehydrating apparatus for meat, to Johnson. This is an apparatus that uses ammonia or carbonic acid for the refrigerant. It is stated in the paragraph commencing on line 10 of the first, the paragraph commencing on line 10, refers to what he has mentioned in the previous patent, in this patent on line 24 he states: "To this end I employ a cold storage warehouse at the shipping point, and at an intermediate station where it is desirable, in which refrigeration is carried on by compressing ammonia gas into receiver and radiator by means of prior appliances and allowing it to expand when cooled in the manner commonly practiced in manufacturing ice. The patent says and describes the central station, refrigerating and cooling plant at the right hand side of figure 1 of the drawing, a refrigerator car and a track shown at the left hand side of figure 1 of the drawings, and connections piped from the storage warehouse which is at the right, into refrigerating cars, 17, in the car, the idea being that the car will be cooled and the pipes charged with the refrigerant, and will then be transported to some other point where another storage warehouse is located where the car may be again artificially cooled and sent on its way.

The specification commencing on line 103 and running on to page 2, line 103 of page 1 and running on to page 2, and reads:

"1. One, reducing cold storage warehouse.

"2. Representing an air pump driven by steam, water, or any suitable power, so as to compress the ammoniacal gas into a radiator.

"3. Which may be of any usual form, for example, a coil of the requisite length of radiating surface to cause the compressed gas to be cooled at atmospheric temperature with sufficient expedition. Fans and water evaporation, or other means, may be applied to the external surface of this radiating coil to assist the cooling of the compressed gas."

The so-called radiator, 3, which is shown on the roof of the storage warehouse only is not described at great or more length than in the statement I have just read. It says: "Maybe of any usual form, for example, a coil of the requisite length of

Sessions Disparages Patents Offered by Defense

radiating surface to cause the compressed gas to be cooled to atmospheric temperature with sufficient expedition." And, that fans and water evaporation may be applied to assist the cooling.

Now, this, it must be remembered is an ammonia refrigerating plant, and the usual form of condenser apparatus is a coil or series of coils of large iron pipes which have water playing over them to cool the refrigerant and contents, so that nothing else can be deduced from this patent as I see it, other than that the usual iron pipe condenser was to be used. This is a far cry from the warehouse with a power plant in it, and a freight car opposite it to be refrigerated to the small, compact, Wolf machine, and as an engineer of many years' experience in designing machinery, I am frank to say if I should have to set about designing a household unit I could get no help from this patent to Johnson.

Audiffren machine, patent No. 898,400, a very ingenious device.

The fifth patent in the order taken up by the defendant is number 898400, to Audiffren, et al, for a rotary refrigerator machine. This is a very special design of apparatus. I think it is extremely ingenious. I saw one of these machines in the Johns-Manville office building in Cleveland, I think about 1912 or 1913, and it struck me at once as being an extremely ingenious machine.

It has a compressor which is mounted in a casing that is suspended upon the main shaft, the casing is free to revolve upon the shaft, but is prevented from revolving by a lead or other weight, small (f), which tends to keep it in an upright position.

There is a crank or eccentric, small (v) upon the shaft, which operates the piston, small (r) causing it to oscillate or reciprocate it back and forth in the cylinder. The refrigerant is compressed into the hollow sphere, small (b) and is there cooled by the evaporation of water upon the surface—from the surface of the sphere. The sphere, (b), rotates with the shaft (A) and is immersed in water for a portion of its diameter. As the sphere rotates its upper surface being wet by the water through which it passes, throws off particles of water, and the air picks up these particles and causes rapid evaporation, thus cooling the water and the surface of the sphere, and thereby cooling the compressed gas in the sphere. There is a fan, small (7), which introduces a current of air through the cover, (5), which is placed over the sphere, and there are openings, (8), at the left hand side of the machine shown in figure 1 that admit air into the compartment in which the sphere is located, and other openings on the right hand side. There are arrows on the drawing that show the direction of the currents of air entering these openings, and then another arrow showing the air going out through the fan (7). By drawing the air in from the left some of it at least passes over the surface of the revolving cooling element, which is the drum mounted upon the shaft at the left, the drum (c). The air is thus cooled before it strikes the wet surface of the sphere, picks up water, causes rapid evaporation of the water from the sphere, and thereby cools the refrigerant within the sphere. This refrigerant is picked up and carried to the evaporator or refrigerating element (c), from which it is again returned to the compressor through apertures through the center of the shaft. This is a special machine that I cannot see how any engineer could regard as teaching anything in the way of how to design the Wolf machine on the patent in suit.

Q. Do you recall the order of the size of the Audiffren machine that you saw in Cleveland you say about 1912 or 1913?

A. I do not have an accurate recollection, but I should say that the sphere was 14 or 16 inches in diameter, but I might be in error as to that.

French patent practice mentioned.

The Audiffren French patent number 372886 to which you have drawn my attention, is similar in all essentials to U. S. Patent 898400.

The patent of addition of 1908—

The Court: Just what do you mean by "The patent of addition"?

The Witness: It is like the appendix to a published book.

The Court: It is an improvement on the other patent?

The Witness: Yes, not a reissue but an improvement.

The Court: Rather than require a new patent they call it an improvement?

The Witness: Yes.

Mr. Cooper: But the Frenchman gets a certificate of addition only for the length of the original term?

The Court: It is the same thing we would do here by an original application and getting another patent.

The Witness: Yes.

The Court: Do they require them to use all the skill and knowledge they had for a new patent?

Mr. Cooper: I don't know how it works out, but I think as a practical matter it is a matter of assertion that that particular thing falls within the original, so when the improvement goes out the improvement as well as the original is free to anybody to use.

In this patent of addition, number 8405, addition to the French patent number 372886, there is shown an improvement, and the improvement consists of a provision of two fans, 7, and a pedal wheel, 9, which is driven by the impact of the water thrown off by the revolving sphere to drive the fans 7. The openings through the air enters the sides of the casing of the machine are a little different in number and disposition from what they are in the original patent. The casing, 5, having been made considerably higher in the patent of addition. There is nothing in this patent that differs in any way and principle of operation from the original or main patent, number 372886.

Brands French machine by Fascio as a freak design.

In the French patent 401989 to Fascio, there is shown what I understand to be a mercury pump for compressing the gas, and this mercury pump is operated by the rotation of the shaft upon which the pump is situated. The patent appears to be a modification of the Audiffren machine, and this mercury centrifugal pump is substituted for the sphere and reciprocating piston pump of Audiffren. The refrigerating element, 15, appears to be similar in principle of construction and operation to the refrigerating elements in the Audiffren machine. In this Fascio patent there are coils, 9, connected at their bottom ends to a hub which in turn is connected to a mercury receptacle, the centrifugal force throwing the mercury outward and entraining gas from the pipes, 8, which are connected by means of a duct, 21, with the refrigerating element, 15, this gas being carried around in the coils, 9, apparently as compressed, and the heat developed abstracted at the same time by the rapid rotation of the coils in the air. This thing, in my opinion, is deservedly called a freak machine, and would afford no help whatever to an engineer who wished to design a household unit of the stationary condenser type.

Mr. Cooper: There are half a dozen papers I have had marked for identification, and before I forget I would like to offer them in evidence. That is plaintiff's exhibit 9, which is the machine.

The Court: Admitted.

Mr. Cooper: Plaintiff's exhibit 15-A and B.

The Court: Admitted.

Mr. Cooper: Plaintiff's exhibit 17, the Flintlock condenser.

The Court: Admitted.

Mr. Cooper: Plaintiff's exhibit 18 which is a rough sketch made by Mr. Hayes on cross examination of the same thing.

The Court: Admitted.

Mr. Cooper: And plaintiff's exhibit 19, an advertisement of the Domelre.

The Court: Admitted.

Mr. Cooper: And an advertisement of the defendant, which he admits putting out, which is not yet offered, or marked, but which I am now offering, and I wish considered as an admission against interest.

The Court: All right. Have it marked and it will be admitted.

Q. One more group of patents of household machines of which Mr. Van Deventer named three, stating that the three were as good as 300, and I will ask you now as to those three, which were the Whitaker, United States Patent 911635, Emerson, 962704, and Brady, 1037423, patent 911635—

Analysis of Whitaker patent No. 911,635 by Plaintiff's witness.

A. Patent 911635 to Whitaker shows the machinery only and does not show any food box or other compartment to be cooled. This patent has a pump, a condenser, a receiver, all enclosed in a tank and submerged in water. He says ammonia is used as his refrigerant, and hopes to be able to keep the compressor and condenser and receiver all cooled by the same submergence of the entire apparatus in a tank of water. There is nothing in this patent as such to suggest the Wolf construction. The specification on page 1, line 60—commencing with line 47, describes in general the apparatus, it reads: "The pump is secured within a tank, 3, as shown in the drawings; it is bolted to the bottom, 4, and this tank is adapted to be filled with water, a wall between the gas pump, the cooling coil and ammonia receiving vessel, the pump is provided with a sleeve 5, through which a shaft 6, passes, the sleeve being screw headed at 7, and provided with a shoulder 8, and so forth, and at line 60 it refers among other things as follows: "Within the tank there is arranged the cooling coil 11 and the ammonia receiving vessel 12."

On page 3, commencing with line 109, he states: "by placing the pump, coil and ammonia vessel within the tank and mounting the motor over it, a device which is extremely compact and which will occupy a minimum of floor space is provided."

I regard this as another freak design, which would offer no inkling of how to build the Wolf machine.

Q. Have you observed that on page 3, about line 96, provision is made to stop the apparatus from operation that if the water in the tank is out?

A. Yes. That part of the specification to which you refer reads, commencing with line 96: "should for any reason the supply of water to the tank 3 be stopped, the expansion valve will be closed before the temperature of the water within the tank is increased to an alarming extent, the expansion valve being closed, no more gas will enter the expansion coil and consequently the pump will do the working against a vacuum. When the motor 13 is stopped, the expansion valve will be closed by means of the cut off mechanism, so that there will be no leaking in the system at this point."

Comments on Emerson patent No. 962,704 by Mr. Sessions.

The patent to Emerson, No. 962704, shows a food box with a motor driven compressor mounted in a compartment above the food box, and a condenser coil which is not lettered, but which is within the tank 16, the closed tank 16, which is a water cooled tank. It is not an air cooled machine in any way.

The specification on page 1, commencing with line 34, reads: "Upon the top of the receptacle five is mounted casing 12, in which are installed suitable parts of a system for the circulation of a refrigerating medium, such installation being herein shown as comprising a motor 13 driving a compressor 14 pipe in the usual manner to a condenser 16, the coil of which communicates through a receiver 17 with an expansion valve 18, from which extends a supply pipe 20 for the refrigerating coil 21," and so forth.—It is purely water cooled.

Q. Do you notice any other reference to the refrigerant than at line 99 of page 1, where ammonia is mentioned?

A. No, that, I think is the only reference. This reads, commencing with line 97: "in use the circulatory system for the refrigerant operates in the customary way, the ammonia or other refrigerant being compressed and condensed in the devices 14 and 16."

The Court: The difference there is water cooled and air cooled, and the size of the pipes in here (indicating)?

The Witness: Yes, and the fan for circulating.

The Court: And the fan goes in with the air-cooled, I take it?

The Witness: Yes, it is all there excepting those tubes, I believe. The refrigerating coil, I believe, is immersed in brine, but I do not consider that any part of the combination of the Wolf Patent.

Brady patent No. 1,037,423 describes portable apparatus.

A. (Continuing) The next patent under those which Mr. Van Deventer considered to be household machines is Brady 1037423, for portable refrigerating apparatus. This patent shows a refrigerating apparatus in a compartment at the left of the food box, but the entire patent is directed to the construction of the food box compartments. On page 1, commencing with line 20, the specification reads: "a further object of the present invention is the provision of a refrigerating plant adapted for use in homes, stores and the like, the same being so constructed as to dispense with the use of ice, and a mechanical or motor operated refrigerating mechanism being operably connected to produce a refrigerating effect upon compartments for holding articles to be refrigerated." But the entire specification and the claim is directed to the construction of the food box.

There is a compressor 7 driven by motors 10 and 11, the compressor delivering the compressed gas into a condenser 13, which is water cooled, and the gas then passing through the pipes that are located in the compartment 6 and the compartment between the upper and lower halves of the box.

The Court: I take it you find the same things lacking in this one and the previous one, the fan and that it is water cooled instead of air, and the size of the pipes—

The Witness: And in this, the entire arrangement is merely diagrammatic, which teaches nothing to a designer other than disclosing principles.

Q. I think you have mentioned 7 as the compressor there, in No. 1037443. Look at the specification?

A. Oh, 7 is the motor and 10 and 11 are the compressors.

Q. Ammonia is the only refrigerant mentioned there?

A. Yes. That is found on page 1, commencing with line 3, reading: "operably connected to the motor 7 is a crank shaft 9 which operates the air pump 10 and the ammonia pump 11, a conduit 12 leading from the ammonia pump to the ammonia condenser 13, disposed within the compartment 3 near the top thereof.

Q. Now, the next group that was taken up on the defendant's side was under the head of patents indicating small tubing in refrigerating apparatus, and there, there were considered United States Patents 85,719 to Tellier, 692,962 to Worth, 726217 to Coleman and 1189470 to O'Brien.

Will you discuss those, please?

A. Before doing that, I would like to say that in this patent No. 1037423, there is mention of an air pump 10 and ammonia pump 11. I do not find any function of an air pump stated. I do not know what use is made of it. Possibly compressed air is blown by the air pump through the condenser, but there is nothing to indicate whether it is connected to the condenser or not.

The Court: Does he mention water cooling?

The Witness: No, I assume it is water cooling, because the pipes of the condenser are enclosed in the tank 13, which is the ordinary method of water cooling, by direct contact of water with the coil.

The Court: What would the compressed air be for, if it was not for cooling? You say that it mentions compressed air.

The Witness: An air pump, and air pump of this sort would be a heating device.

The Court: You mean a compression device?

The Witness: It would develop heat. The air itself would have to be cooled before it could be used as a cooling agent. If it were compressed the air would have to be cooled.

The Court: What do you take the purpose of the air pump to have been?

The Witness: I don't know. The patent does not state. The claim of the patent is directed only to this double compartment box.

Q. Now, for the patents on small tubing which are listed in the previous question: Have you got those I have mentioned?

Coleman patent No. 726,217 is on drinking water cooler.

A. Yes, I have them: Patent 726217 to Coleman is for a refrigerating system. The apparatus shown is a drinking water cooler in which there is a coil, 7, in which the cooling or refrigerating medium is expanded, and there is a coil, 1, which is a holder for the compressed gas. The only mention of that is on page 1, commencing with line 45, which reads: "The compression apparatus by which the expanded refrigerant medium, such as ether or other analogous fluid or vapor, is drawn from the cooling chamber and forced into the storage chamber, will in the present improvement comprise the following described mechanism."

Then he goes on and describes the mechanism, which is a mercury pump, which compresses the gas. There is a screw propeller type of pump for returning the mercury to the chamber 5, from which it dropped, to entrain the gas and compress it into the compartment 8, from which it follows, to the holder 1, or storage chamber, as it is called. The specification on page 2 says: "in the operation of the present apparatus the expanded refrigerant medium is drawn from the expansion chamber 2 through pipe connection 7 by the injector 4 and compressed into the upper part of the receiving or separating chamber, from whence it passes through the pipe connection 10 to the storage chamber 1 to be again expanded in the expansion chamber 2 in the continued operation of the apparatus."

As I recall Mr. Van Deventer's discussion of this patent, he compared the size of the tube 1 with the spigot and deduced the fact that the pipe 1 was of small diameter, something on the order of ⅜ inch. While this may be a proper analysis of the proportions of this patent structure, there is nothing to suggest either in the drawing or the specifications that such a pipe would be suitable for use in a refrigerating apparatus on the order of the Wolf patented apparatus.

Q. (By Mr. Cooper): Did you ever see a mercury pump of such a construction as claimed here, run by an electric motor or otherwise?

A. No, I never have.

Tellier patent No. 85,719 gives ether as the refrigerant.

The next patent to which I will refer is that of Tellier No. 85719. This patent is for an ice machine in which the refrigerant is methyllic ether. The specification devotes a considerable space to his process for preparing the ether.

The apparatus that is shown for the use of this ether is found in figure 1 of sheet 3, and in the figures on sheet 3 the top figure of sheet 1, there is a compressor or pump which is seen at the righthand side of figure 1, at the top of the un-numbered figure of sheet 1. The compressed refrigerant enters the condenser coil G and from there passes to the cooling or refrigerating apparatus (A). The apparatus shown is for cooling air.

The specification on page 2, the last paragraph, reads,—

Mr. Cooper: That is the last paragraph of column 1.

The Witness: "This pump, by means of valves working in ordinary conditions, exhaust constantly the vapors which are formed in the congealer, and drive them into the condensing coil (b). This coil is immersed in a current of cold water which enters the lower part of the tank (b), and rises through it, completely and constantly enveloping this coil."

This is not an apparatus that could be installed in the household. It seems to be large enough to occupy a complete plant; it does not have an air cooled condenser, and there is nothing to indicate the size of the tubes that would be used.

Q. Well, Mr. Van Deventer called attention to a passage on page 3, column 1, about two-thirds of the way down, where it is said that the refrigerating tube (a) is made of an iron cylinder forming a strong outer jacket, within which are lodged a number of small tubes, half to ⅜ of an inch in diameter, part of which may be seen, X X X X."

Will you state the relative sizes, as you see them, of those ½ or ⅜ inch pipes in the evaporator with the diameter of the pipe in the water cooled condenser?

A. They are very much smaller, not more than one-half as large. I cannot determine,—I should say not more than 1/3 as large, on examining them under a glass.

Q. The condenser coil is three times or so in diameter, greater than the ½ or ⅜ inch pipes in the evaporator?

A. Yes.

The Court: What do you say about the condenser coils and the expansion coils being practically interchangeable, so far as use is concerned?

The Witness: I think that depends upon the refrigerant, and the temperatures in which they are used. Of course, they operate by absorption or emission of heat, and in that respect they may be interchangeable. The velocities of the gases in the two devices may have to be determined for economical work. I do not know as to that. I am not sufficiently familiar with the detailed problems of refrigeration to answer the question intelligently.

In neither of the exhibits, plaintiff's exhibits 7 or 9, the defendant's machine and plaintiff's machine respectively, are the condenser coils the same as the refrigerating coils.

Worth patent No. 692962 deals with cooling coil for gas engines.

The Worth patent, number 692962, for cooling and condensing coil, shows and describes what he calls an air cooled radiator, which may be used with a gas engine.

The Court: It is really an expansion coil, though, isn't it, or condensing coil, I mean.

The Witness: It is a cooling coil.

A. (Resumed). The specification on page 1, commencing with line 13, says regarding the invention: "It relates more particularly to coils that may form part of a water circulating system adapted to be used in connection with gas or oil engines for the purpose of carrying away and dissipating the waste heat evolved from the combustion of the charge which would otherwise heat the cylinder of the said engine to a dangerous degree."

There are tubes or a coil of tubes B-2, that are so located that the blades of a fly wheel drives air against the coils and cools the water in the coils.

On page 1, commencing with line 84, the operation is described as follows:

"The pipes, as shown, comprise a path for the circulation of the cooling water of a gas engine. The pipe B may be connected to the top of the jacket of such an engine, and the pipe (b) 4, should be connected to the water reservoir near the bottom. Another pipe should connect the top of the reservoir with the lower portion of the said water jacket. Such an arrangement of connecting the reservoir and engine jacket is well understood by those skilled in the art. As the water becomes heated in the water jacket, it will flow into the coil-pipes (d-2) through the header (B-1) and pipe (b). The pump (c), associated with the shaft (a), may be used to produce a forced circulation of the fluid within the coils, (b-2) and the system of which they are a part when the various devices are so placed as to preclude a natural circulation. When the wheel (a-1) is driven at its normal speed, the ribs (a-4) will beat the air and cause a circulation of air around the coils (b-2). Such a circulation is induced by the difference in the velocity of air confined between the ribs."

It is a very special form of what might be called a radiator. As to the size of the tubing, there is no inkling given as to what it may be.

The Court: How about the material?

The Witness: I beg pardon?

The Court: Nor of the material?

The Witness: Nor of the material.

O'Brien patent No. 1,189,470 covers air cooler and humidifier.

A. (Resuming.) The last patent that is mentioned by Mr. Van Deventer as showing small tubing is patent number 1189470, to O'Brien, for air cooler and dehumidifier. This patent shows a portable blower for cooling air by means of colder water. In the specification, commencing with line 20 of page 1, the inventor says: "My improved device in its preferred form prevents such area of refrigerated or heat absorbing surface, that a cooling medium may be advantageously employed even though its temperature is not very much below the temperature to which it is desired to cool the air. I designed the apparatus so as to cool large volumes of air down to the desired temperature instead of cooling smaller volumes of air to a much lower temperature and permitting them to mix with and cool the air of the room."

(Continues reading): "In its simplest and preferable form, the apparatus is adapted to utilize a cooling medium considerably above the freezing point, as for instance ordinary hydrant water of a municipal water works system, or water from an artesian well, or water pumped from an ordinary well."

From the appearance of the apparatus, it is an electric fan on the desk type of fan for cooling living rooms or offices, mounted in a cylindrical holder, 21, in which there is a coil of tubing which may be connected to the water supply. The fan drives the air through the tubing over the coils, and it is thereby cooled.

That is, I think, not in the same art as the Wolf patent in suit, and it does not pretend to make any ice, or reduce the refrigerant to a liquid.

Q. Now, will you take up patents on air and water combined? Mr. VanDeventer mentioned four: Audiffren, number 898400; Martin and Beath, re-issue 4992; the L. Wolfe, 1064272, and the British patent to Rau, number 23894; but you have already discussed the first two of them, so I will ask you to confine yourself on this point to the Wolf United States patent and the Rau British patent.

Patent No. 1064272 to L Wolf not by same inventor as the patent in suit.

A. Patent number 1064272, to L. Wolf, is for an apparatus for making ice. He speaks of the refrigerant having the characteristics of liquid gas. That is found on page 1, line 12 of the specification.

Then on page 1, commencing with line 64, he refers further to the character of the refrigerant. He says, "In carrying out my invention, I propose to use a refrigerant having the characteristics of liquid gas as stated above, which is a product that is gaseous at ordinary temperatures and pressures, but may be liquefied by the application of a high pressure and by cooling. The refrigerant when in gaseous form is subjected to the required high pressure by means of a pump, 8, of any approved construction, the gaseous refrigerant being delivered to the pump through a supply pipe, figure 9, and being delivered from the pump through a smaller pipe, 10.

"In order to liquefy liquid gas, it is necessary to subject it to a pressure of 80 to 100 atmospheres"—that would be from 1,200 to 1,500 pounds per square inch—"and the heat generated by thus compressing the gas is sufficient to raise the temperature of the compressed gas to somewhere in the neighborhood of 400 degrees C."

That would be 752 degrees Fahrenheit.

"Before the compressed gas is delivered to the tank for refrigerating action, it is liquefied by cooling it while under this pressure and to secure this end, I first subject the heated gas to an air cooling process, which reduces the temperature thereof materially and then subject it to a water or other cooling process which completes the liquefaction." The condenser is a combined air and water cooled condenser. That is, there is a portion of it that is air cooled, a portion, 10, having fins, 12, upon it and the portion 13, that is submerged in the water tank.

He says: "This coil"—referring to the air cooled coil, 10—"may be subjected to natural or artificial air currents, and because of the high temperature at which the gases are introduced to the coil, the temperature thereof will be materially reduced by radiation from the coil, and radiating flanges or rings, 12. From the coil, 11, the compressed gases pass into another coil, 13, which is immersed in a body of water, 14, or some other liquid for further cooling the gases."

This quotation is page 1, commencing with line 14.

Q. Are the temperatures and pressures such as there given in your judgment, utilizable in household refrigerating apparatus?

A. Well, I don't know whether they are utilizable, but I know that I would not have one of those temperatures or pressures in my house. The temperature of 400 degrees Centigrade is above the melting point of lead, it is almost up to the melting point of aluminum, and I do not see how any apparatus developing those temperatures could be used except by water cooling throughout and everywhere wherever those temperatures are liable to be created. The pressures are high enough too; in my opinion, they should be prohibited in the household.

British patent No. 23894 to Rau shows combination of air and water cooling.

British patent 23894 of 1901, to Rau, is for an "Improved evaporative surface condenser for refrigerating machines."

In this machine the coil that transmits the refrigerant is the coil C, which is shown in the vertical tank or cylinder, A, and concentric with the outside cylinder A, is another cylinder of smaller diameter (d) and the coil (c) stands in the space between these two cylinders, A and B. Water is sprayed upon the top of the coil, C, from the pipe, J, which is shown perforated, and emitting water upon the top of the coil, C. At the same time, air is drawn into the annular space between the tubes, D. and A, down near the bottom of the coil, C, where it enters the inner tube (D) and is carried upwards again by means of some kind of an exhaust fan, K. This is a good example of evaporative cooling and direct water cooling, the direct water cooling being from the water that is seen in the bottom of the annular space between the cylinders A and D. The lower part of the condenser coil is submerged in this water; that is, at the bottom of this space.

This is a combination of direct water cooling atmospheric air cooling or evaported cooling.

Q. The next group of patents to which the defendant's expert referred were those that relate to the use of the air alone, and he listed seven here, including the Fascio patent 41989, of France, which you have already discussed. I wish to ask you to continue briefly with the other six, that is, Lowe 63413, Evans 329380, Coleman patents 709814 and 1014120, also the Hill British patent 17071, of 1888, and the French patent to Birk, 451705.

A. The French Fascio patent 401989, which I have previously discussed, shows air cooling alone, but there is also the mercury which follows along with the gas, which absorbs the heat, undoubtedly assists in transferring the heat from the gas to the outer atmosphere. This Fascio patent instead of blowing air over the condenser coils moves the condenser coils rapidly through the air. I have not a copy of the Lowe patent.

The Court: What force do you attach in the patent to the statement that the air passes over the condenser coils to the compressor?

The Witness: Well, that aids in keeping the apparatus generally cool and preventing the heating of the compressor. Just what that is I don't know, and I think it would be difficult to determine even by accurate tests, but the fact that the air is moved over to the compressor where considerable heat is developed undoubtedly aids in the cooling of the refrigerant and keeps the apparatus within the limits of working temperatures.

This patent 63413 of 1867 to Lowe for the manufacture of ice; the patent shows

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what purports to be an apparatus for carrying on the refrigerating process, but it is extremely crude, and certainly nothing that would enable an engineer to use as a measure for determining any proportions of the Wolf patent in suit.

He speaks of different gaseous bodies that may be used, in the second paragraph of the specifications, where he says: "Certain gaseous bodies, such as the atmospheric air, oxygen and hydrogen, do not change their state as above."

That is, convert into liquid under pressures.

"Certain gaseous bodies, such as the atmospheric air, oxygen and hydrogen, do not change their state as above. Carbonic acid, sulfurous acid, nitrous oxide, and some hydro-carbon gases are examples of bodies which ordinarily exist in the gaseous state, and which by mechanical compression are converted into liquid state, as above stated, and it is such that I employ my process, preferring, however, carbonic acid."

We have learned at this hearing that carbonic acid requires very high pressures, and consequent temperatures in order to liquefy.

The Court asks some pointed questions on the laws of gases.

The Court: Would those machines work if you did not liquefy—compress them until you got a temperature sufficiently high so it would be cooled by temperatures, a temperature at which it expands again?

The Witness: They would cool whatever they are in contact with. There is always heat required to expand the gas, but the latent heat of expansion—or the heat required to expand in changing the character of the substance from liquid to gas or from a solid to a liquid is very small, and that would be a very inefficient way. That is the great objection to the use of compressed air.

The Court: Where does that liquefy?

The Witness: I don't know at what temperature it does, but it has to be compressed and cooled, and compressed and cooled a number of times, and I don't know what the final temperature and pressure is.

The Court: It is higher in all those you speak of—as ammonia. But the big, radical, sudden change comes, that change from the liquid to the gas, the big reduction in temperature comes at that particular point.

The Witness: Yes, the change in the condition of the substance from liquid to gas or from gas to liquid, or from liquid to solid, or solid to liquid.

The Court: Gives the big change in volume?

The Witness: Yes.

The Court: Right at that point?

The Witness: Yes.

The Court: Two degrees in temperature there and pressure makes a great big change in volume.

The Witness: Yes.

The Court: A small difference in pressure makes a big change in temperature, I was trying to say, is that correct?

The Witness: But, during the process of conversion from gas to liquid, or from liquid to gas, there is no change in temperature, it remains at constant temperature.

The Court: There is a big change in temperature between the condensed liquid and the expanded gas, isn't there?

The Witness: No, no.

The Court: Take a cubic inch of liquid, and when it becomes vapor it takes up a larger space I suppose, doesn't it?

The Witness: Yes.

The Court: With a corresponding reduction in temperature?

The Witness: No, I will illustrate that by the glass of water with a chunk of ice in it. You put your thermometer in a glass of water that has ice in it, and it will be 32, and 32 after the ice is melted. There is what is known as latent heat involved in that change, your Honor, it is some molecular development of heat that is not sensible to a thermometer.

The Court: A pint of water changing into gas occupies how much space?

The Witness: Well, I don't know.

The Court: But there is not any more heat in the big space than in the little space of water.

The Witness: That is correct.

The Court: Therefore, I thought a big reduction in temperature would result.

The Witness: No, there is no change in temperature due—in the period of change—no change of temperature in the period of change in condition.

The Court: Take it the other way around, in your gas you have a cubic yard of gas, and compress it to a cubic inch of liquid, and the reason you increase the heat is because you have carried all the heat in the cubic yard of gas down to the cubic inch of liquid, isn't it?

The Witness: Yes, sir.

The Court: Then, on the reverse of that, when you reduce that pressure and your cubic inch of liquid—

The Witness: In a cubic inch of liquid, your Honor, when we compress it down, you can compress it to a cubic inch, but it is still gas, and then when it converts into liquid it must give up a large part of the heat that you have compressed into that space, it gives it up to the air.

The Court: Suppose you held it in, and you have it very, very high.

The Witness: Yes.

The Court: Then, if you release that, and let it expand back into the big space again, then it goes back cool.

The Witness: Well, that is very hot, it has a great deal of heat in it.

The Court: But if you take your cubic yard of gas, that sulphur dioxide, say, and press it into a cubic inch of liquid, you have all the heat in your cubic inch that you ever had in your cubic yard of gas, haven't you?

The Witness: Well, your Honor uses the word "Liquid," you cannot press it into a cubic inch of liquid, but you can keep a cubic inch of gas and then let it expand and it will cool.

The Court: Can you press it into a quarter of a cubic inch, and if you do then you have a liquid?

The Witness: No, you have not until you have taken the heat out of it. It would be very hot if you compressed it into a quarter inch.

The Court: Can't you ever press it down into a liquid?

The Witness: No, sir, not without the extraction of the heat from it, it will not liquefy at any pressure.

The Court: You come to a temperature finally, don't you, where you can compress it into a liquid, or release it and it will be a gas, without changing the temperature?

The Witness: No, sir.

The Court: Well, where is it—take sulphur dioxide, at what pressure and temperature will it go into a liquid?

The Witness: At a great many different pressures and temperatures.

The Court: Well, get down to where it will and then release your pressure and hold your temperature as it was.

The Witness: No, you must keep your pressure on.

The Court: But I was not going to, just to be contrary, suppose I don't; take any given temperature, and a given pressure that it will liquefy. Now you release your pressure and leave your temperature just as it was, won't that jump back into a gas?

The Witness: It will boil as rapidly as it can, but from the boiling as you saw Mr. Hayes perform it the other night, it cools in the container, ceases to boil, so it is a gradual operation, it is not a quick change, but it gets there eventually.

The Court: But it seems to me there must be a temperature at which with enough pressure you have a liquid, and at the same time, at the same temperature you have gas. Maybe I am wrong about it, but it seems to me there would be somewhere in the scale there would be a change.

The Witness: There is a certain pressure, a critical pressure at which it will become a liquid.

The Court: And at that same temperature with a different pressure you could have a gas, couldn't you?

The Witness: Yes.

Q. In this Lowe patent which we are discussing under the head of patents under the use of air alone, do you find that Lowe cools his condenser by air alone?

The Witness: No, near the bottom of the first page it is said: "The compression of the gas evolves a large amount of heat, and it is important to carry this heat off so as to facilitate the passage of the gas to the liquid state. To effect this the eduction pipe is formed in a coil and placed within a pump or receptacle supplied with a running stream of water through it."

Double pipe condensers shown Evans patent No. 329380.

That is a purely water cooled condenser.

Q. And the Evans patent 329380, which is in the same group, or was put in the same group by the defendant's expert?

A. This patent, 329380, is one in which the inventor proposes to use either air or air and water in what is known as the double pipe condenser. In the double pipe condenser there are two concentric pipes, through one of which, the central one of which one of the elements passes, either the refrigerant or the cooling agent, and through the annular space between the pipes the other agent passes, and this inventor shows the inner pipe 9, and the outer pipe 10, with air or air and water passing through one of the conduits, or ducts, and the refrigerating agent passes through the other.

On page 1, commencing line 8, the inventor states what the invention is for.

"My invention relates to apparatus for refrigerating purposes, such, for example, as that employed in the manufacture of ice by the artificial production of low temperatures effected by the alternate expansion and condensation of ammoniacal or other equivalent gases."

Then he refers to the objections formerly applied to the methods of cooling in the following paragraph reading: "In the practical use of mechanism of this class, one of the most serious obstacles encountered is the very large consumption of cold water required for the absorption of heat from the pipes and for the condensation of the steam, together with the hot ammoniacal or other gas used in apparatus of this class. My invention has for its purpose the avoidance of this objection by substituting for the large volume of cold water heretofore required, a continuous artificial current of air under compression or air and water combined in varying proportions and at temperatures between the normal and the freezing points."

In figure 2 there is shown not only the concentric double pipe apparatus for condensing, but a tray, 25, which has cooling water in it that may be dripped upon the condenser pipes."

On page 2, commencing with line 74 he states: "The operation may be considerably expedited by placing a drip-trough, 25, above, from which water is constantly sprinkled upon the pipes, 9, of the coil, the heat being rapidly absorbed by the moisture, and the refrigeration greatly accelerated by the rapid evaporation which is promoted by the thorough circulation of the air." So, there are several kinds of cooling effected or proposed in this apparatus.

The Court: Does that lessen the value of the one use of air, does that lessen it because he tells about another?

The Witness: No, it is just as good regardless of how many he tells about, but the way he puts the air over the coils, is to force it through one pipe that has another one within it, concentric. It is not what you might call exposed to the atmosphere.

Q. Well, is that arrangement, the concentric tubes, one that adds to the expense of manufacture?

British patent No. 17,071 to Hill shows horse-driven machine.

A. Vastly so. British patent 17071 of 1888 shows a machine which is operated by a traction of the wheels of a vehicle on which it is mounted, to be drawn by horses, or upon a horse powered stationary machine, driven by a beam and vertical shaft. The specification says on page 1: "Our invention relates to refrigerating and ice making machines, and its main object is to provide a machine of this kind or class which will be very advantageous for military and other purposes. An important feature of our said invention is the construction of a machine mounted upon wheels in such a manner that it can be very readily transported or moved from place to place by the tractive force applied to the machine for the purpose of producing the cold."

"Another feature of our said invention consists in so constructing the said machine that, while it is stationary, the mechanism for producing the cold can be driven by a horse or other animal power moving in a circular path, or by manual power, or by other suitable means."

Then there is another mention of the condenser.

"Another feature of said invention is the provision of means whereby the condensation of the ammoniacal gas or other refrigerating agent may be effected either by means of water or by means of atmospheric air."

The condenser is mentioned as the part, large E, which is shown as some kind of a receptacle or tank, and standing upright on the platform of the machine, but there seems to be no connections to it other than possibly one pipe in the center at the top.

It says on page 3, commencing on line 27: "The ice box or cooling chamber, large D, condenser large E, and pump, large F, may be of any suitable construction.

"It is obvious that the construction and arrangement of the mechanism may be somewhat modified without departing from the nature of our said invention. For instance we sometimes make the condenser so that it can be used with either water or air as the cooling medium. Or we provide two condensers, one for use with water and the other for use with air. And in the latter case we provide a suitable fan or blower arranged to be driven from the driving shaft (d)."

This is a very special arrangement of refrigerating apparatus, there is no food box shown, and it is impossible to determine whether it is brine cooling or what kind of cooling is carried on.

Q. It does not describe the construction of its condenser so you can tell whether it is susceptible of any cooling or not?

A. No.

Q. Let us go on then to the two claims mentioned in this heading of the use of air alone, 709814 and 1014120, the patent number 709814—

A. Patent number 709814 is for refrigerating apparatus in which there is a refrigerating coil, too, tank and condenser, 1. The tank condenser, 1, is provided with radiating fins, and there is a very special form of motor used, comprising electric magnets, 14, and keeper, 15, that is attracted to the magnets to force the plunger, 13, downwardly in the cylinder, 12, and force the liquid up through the holder, 11, through the condenser and into the refrigerating coil. The drawings are purely diagrammatic, and no proportions or sizes are given that would enable one to use in designing anything in the way of refrigerating apparatus, and certainly would form no—

The Court: Any fan on it?

The Witness: No, no revolving parts in this apparatus at all. Simply a reciprocating plunger operated on the one end by electric magnets and on the other by the hydro-static head of the refrigerant.

Q. Do you think that sort of a scheme would work in a practical way?

A. I do not. I think it is a very insensible arrangement.

Q. No statement here of what his refrigerant is, I believe. Well, you need not answer that as a question.

A. I think not. No, I do not see any mention of it.

The Court: It was evidently air cooled, wasn't it?

The Witness: Yes, a stationary tank with fins, and as shown in the drawings, the fins are horizontal, which would not cool as rapidly or as readily as they would if the fins were vertical, the tank horizontal and the fins vertical.

Coleman patent No. 1,014,120 another freak according to witness.

A. (Continued) The next patent in order in this group is 1014120, to Coleman. This patent shows an injector type of pump, 1, and a condenser, 2, which is tank having radiating ribs or fins upon it. It is a purely diagrammatic drawing showing the circuits of the refrigerant or the fluid that is used, and offers no help in the design of such an apparatus as that of Wolf. It has no coil in the condenser.

The Court: What is the gas jet for down at the bottom space?

The Witness: That creates the pressure in the tank, just above it in the boiler, which, when the liquid drops, there is a float 20 in the tank which operates the valve 19. When the liquid in the boiler drops or lowers its level, the gas escapes up through the ventura nozzles 14, and carries the refrigerant around through the cycle of compressions.

The Court: Where do you get compression?

The Witness: Simply by forcing this into an injector tube.

Q. Do you believe that would work?

A. I do not. It is very much of a freak.

French patent No. 451705 to Birk describes an air cooled machine.

Q. Now, the other patent in this group is the French patent to Birk. In this French patent number 451705 to Birk for a refrigerating machine, the patent is dated April 25, 1913. In this patent there is a refrigerator box having a food compartment, figure 20, and outside of the box on one side there is a motor and a compressor. At the top of the box there is located a condenser which consists of a tank 18 having radiating ribs or fins upon it, spaced apart throughout its entire length. Within the food box there is an evaporator or refrigerating element 19, which appears to be a duplicate of the condenser.

The gases that are compressed in the compressor pass up through the pipe that it shown at the right of figure 6, into the condenser, 18, where they are cooled and liquefied.

The Court: In what manner are they cooled?

The Witness: They are cooled by the air, abstracting the heat from the tank and the cooling fins of ribs 5. From the tank 18 they pass through the expansion valve 21 into the tank 19, where they are again converted into gas and abstract the heat from the food box, and when converted into gas, the refrigerant is sucked back into the compressor, re-compressed and re-circulated.

This is an example of air cooling with a tank. There is no fan for blowing the air over the condenser, the cycle is of the same order as that of the Wolf patent in suit.

Q. Would that Birk arrangement operate successfully as a refrigerating device, in your opinion?

A. No.

Q. On what is that opinion based? I mean, why do you say that it would not?

A. I have seen a machine of this type, in fact, had one constructed as near as possible as shown in the drawings, and after running a few weeks, it destroyed itself from lack of lubrication. The oil did not come through to the compressor.

Q. Where would it lodge?

A. It lodged in the evaporator or cooling tank 19.

Q. Now, Mr. Sessions, after your consideration of all of these prior patents, do you find any sufficient disclosure among them all that would guide you, as an engineer, or would have guided you as a designing engineer, in 1913, as to how to build an air cooled household refrigerating machine?

A. I find a great many ideas, but they are not consistent. One shows one thing and another another, and to choose between them, coming into the art and be looking up these patents in 1913, or even today, so far as the knowledge that can be obtained from these patents, it is not harmonized, there is too many different things proposed, and it would be difficult to follow any one of these patents. In fact, I don't know how you could follow anyone, and if you attempted to combine them, I don't know what results you would get.

Q. Do you find in any or all of them, taken together, a solution disclosed in Wolf's patent in suit, and claimed in the claims in issue?

A. I do not.

Q. What have you to say on the question of whether you, as a designing engineer in 1913, or thereabouts, could have devised a successful commercial household air cooled refrigerating machine?

A. From the study of these patents?

Q. Yes, in connection with that study?

A. I could not have designed one.

Q. Now, assuming it to be established here that copper tubing of any or all diameters from 1-8 inch to 2 inches or above, was well known prior to Wolf, and that pieces of all sizes or any of the sizes known were in refrigerating manufacturing plants of a period prior to and up to 1913, would that fact have helped you, as a designing engineer, in determining the proper solution of the problem?

A. No.

Mr. Cooper: That is all I have to ask, your Honor.

(Recess.)

Interchangeability of condensers and cooling coils.

Cross Examination

By Mr. Frye:

Q. Now, regarding this question of interchangeable condensers, and refrigerating coils, do you know if there is any company at the present day making refrigerating apparatus with interchangeable condensers and refrigerating coils?

A. I am not aware of such.

Q. Do you know the refrigerating apparatus made by the American Radiator Company.

A. No, I do not.

Q. I call your attention to this circular of the Fridger Company, which was marked for identification, exhibit 46, and ask you if that shows a refrigerating apparatus for household use with apparently the same constructed condenser and refrigerating coil?

A. I am unable to state whether they are the same or not. They appear to be of the common steam or hot water radiator type, but whether the coils are alike, I cannot say.

Q. How many sections are shown in each of the condensers and congealer coils shown there?

A. Six.

Q. Do you see, in the fly wheel adjacent to the condenser, a plurality of fan blades?

A. I see something that appears to be of that sort.

Q. Would you state as an engineer that that is an air cooled condenser?

A. One cannot tell from this picture how close the condenser coil is to the compressor.

Q. Well, let me ask this: Do you see any water pipe connections, or anything of that kind that would lead you to believe there is a water cooled condenser there?

A. There is nothing to indicate a water connection that I can see.

Q. And there is what you say appears to be fan blades?

A. Yes.

The Court: Has there been any proof about that exhibit?

Mr. Frye: No, your Honor, it is not an anticipation—the exhibit itself says it was mailed in 1917.

Mr. Cooper: There is no proof about that, in answer to the Judge's question.

Mr. Frye: No, we want to merely show by this witness the statements about the interchangeable things, show they are uninformed or deliberately mis-stating.

Mr. Cooper: I object to that statement. I will now object to any question about this since there is no proof of it. It seems to be a mailing card or something, and the witness says he cannot tell what it is.

Mr. Frye: This is merely one your Honor. We have got a lot of things on interchangeable radiators if we find it necessary to go into it.

Q. Now, has this French Birk machine that is mentioned in the French patent 451705, interchangeable condenser and congealer coils?

A. They are physically alike, but the connections to them are different.

Q. Well now, have you read the specification of that French patent?

A. Yes, I have read it, but I have not reviewed it recently.

Q. Well, will you tell us if you find any place where the inventor states that in place of the illustrated embodiment, he could use fin tubes and a purality of fin tubes?

A. Yes, there is such a statement in the patent, on page 4 of the translation. There is this paragraph, occupies two thirds of the page from the bottom: "The compressor may also be used as an air compressor, air pump and so forth. It may be provided with a plurality of external fins 17, for taking away the heat produced by compression,"—that is relating to the compressor. "By virtue of the refrigerating system above described the condenser 18, figure 6 and 7 may be operated without water cooling, provided that——— has already been removed near the compressor. For this reason, the condenser may be composed of one or a plurality of finned pipes, cooled directly by the atmosphere. The refrigerating element, 19, figures 6 and 7, may also be composed of one or a plurality of finned pipes. If a coil of pipes is preferred in lieu of the finned pipes, such pipe may be disposed on the wall in the back of the ice box 20. The condenser of the refrigerating element may likewise be constructed like those used in other systems."

Q. Now, I believe you testified that you personally tested a machine of this type, and failed to make it work. It that true?

A. I had one of those machines constructed and put into operation, and it failed after a few weeks. I do not recall the time.

Q. What refrigerant did you use in that machine?

A. Sulphur Dioxide.

The Court: I did not hear the answer.

The Witness: Sulhpur dioxide.

Q. How large was the machine, what capacity?

A. It was a refrigerator of the Frigidaire construction. I think it was a T-5 size. I have forgotten the cubical capacity.

Q. Well, is it comparable to the defendant's exhibit 9 in size?

A. Not as large as that. It has a smaller box than that. It is more comparable to the defendant's—

The Court: Defendant's exhibit 7, you mean?

Mr. Frye: I think defendant's is exhibit 7, yes.

A. (Continuing It is more comparable to a box on the order of the size of the defendant's machine, in exhibit 7.

Q. Now, did you try it with any other refrigerant?

A. No.

Q. What does the French patent itself say about refrigerants?

A. I think it does not mention any kind of refrigerant. I do not find it now, and I was of the impression that it did not, and I don't find it now.

Q. Well, as a patent expert, when a patent in the year 1912 or 1913 fails to recite any refrigerant, what would be your opinion, as a mechanical engineer, in refrigeration work, concerning what refrigerant to use in a test in that machine before you can determine its successful operation or not?

A. I should say that any of the known available refrigerants might be tested.

Q. And if it fails to work with any one, then the machine is unsuccessful in operation; is that your contention?

A. It is unsuccessful as to that one. As to whether it would be unsuccessful with another type could not be told by that test.

Q. Well now, the question was put to ou on direct examination, as I believe, whether in your opinion the Birk patent disclosed an operative device. Now, do you desire to amend your answer?

A. No, not in the slightest.

Q. Do you think it proper for a mechanical engineer, on a single test of a single refrigerant, to condemn a device for all refrigerants.

A. No, I have not condemned it for all refrigerants; I have condemned it as to the test that I made.

Q. Well, what is your opinion as to whether that will operate with, for example, methyl chloride?

A. I know of no reason why it would operate with methyl chloride different than with sulphur dioxide, unless methyl chloride is a carrier of oil, of which I do not know I do not have knowledge.

Q. Well, let's put it this way: Do you know of any reason why it will not operate with methyl chloride?

A. If methyl chloride is not a carrier of oil, it is my opinion that it would not operate with methyl chloride.

Q. How about ethyl chloride?

A. The same answer. If ethyl chloride is not a carrier of oil, then it would not operate with ethyl chloride.

Q. Do you know whether either of them are, as you expressed it, a carrier of oil?

A. No, I do not.

Q. What particular part was it that burned out in your test device?

A. The compressor.

Q. Did you substitute another compressor and try again?

A. Yes.

Q. Then what happened?

A. It had gotten to a very noisy state, it was going the same way that the first one did.

Q. How long did it take to get into that state?

A. Several weeks. I do not know.

Q. Is the second compressor larger than the first?

A. No, the same size. It is the right size for that box using SO2.

Q. Now, I believe you stated that in connection with the Fascio French patent, it was not cooled by air alone. Is that true?

A. Eventually, it is cooled by air. I should have modified that statement, but there is an addition to the refrigerant, mercury in the pipes, that carry the refrigerant, so that the mercury must absorb a considerable portion of the heat and assist the dissipation of the heat.

Q. Well now, think a minute: You start with mercury in the pump and you compress the refrigerant with it into those coils, and I believe you stated a small portion or so of the mercury also goes into the coils. Has that mercury become heated along with the gas during the compression?

A. Yes, the heat of compression of the gas.

Q. Also heats the mercury?

A. Yes.

Q. What takes the heat out of that mercury?

A. The transmission through the walls of the tube.

Q. By air outside the tube?

A. Yes.

Q. Well then, isn't it the fact that the mercury makes it more difficult for the air, rather than assisting the air in cooling the gas?

A. No, no. Mercury is a vastly better conductor of heat than the gas is, and as the mercury picks up the heat it will transmit it to the pipes much quicker than the gas will.

Q. Where does it go to after it absorbs the heat from the gas, what happens,—does the mercury keep getting hotter and hotter?

A. It goes into the air.

Q. But not in the coils?

A. Sure, it goes through the coils. I say that the mercury assists in the cooling of the gas, of the refrigerant.

Q. But eventually, it all goes into the air. Now, do we understand each other?

A. Yes.

Q. Now, in connection with the Martin and Beath patent, and I believe the British patent to Rau, you stated that the receivers were submerged in water. Is that true? Now, the receiver is the part marked "I" in the Martin and Beath, as I understand it, and I thought you used the term regarding the five or six lowermost coils J in the British patent. Have you those patents before you, so that we will be sure we are understanding each other?

A. I have the patents before me.

Q. Now, from your experience as a mechanical engineer—

A. (Interrupting) May I ask you if you wish an answer to your previous question, or hadn't you finished your question yet?

Q. I thought you nodded your head.

A. I do not nod my head to any question. I am aware the reporter cannot hear my head, I hope he cannot yet.

Q. I was not watching the reporter. I was watching you. Go ahead and answer that question.

A. As to the Martin and Beath patent, I did not say that the receiver, I, is immersed in water, but I said that if there was any considerable quantity of water in the receptacle, L, it would be immersed, and if it were so immersed, then there

Final Cross Examination by Counsel for the Defendant

would be direct water cooling in that machine.

Of the Rau patent, English patent number 23894, I said that the lower convolutions, or lower turns of the condenser coil, C, are immersed in the water, in the annular space between the cylinders, A and D, and thereby there is direct cooling of the refrigerant in those coils by the water in that space.

Q. Now, as an experienced mechanical engineer, would you say the refrigerant would be gas or liquid when it reaches the receiver, I, or the lowermost coils of the rod condenser?

A. If the cooling effect of the evaporated water upon the coils, G, of the Martin and Beath patent is sufficient to liquefy the gas, it would be a liquid when it got to the receiver, I.

Q. Now about the Rau patent?

A. The same applies there.

Q. Well now, tell us as an experienced mechanical engineer whether or not you think it would be liquid when it reaches those two points or would it be gas?

A. I think that the machinery could be so arranged that it would be liquid.

Q. Well, doesn't the receiver in ordinary refrigerant language, mean a receptacle for the liquid when condensed?

A. Not necessarily. Those in intermediate receptacle for fluid.

Q. Do you know of any machine where the receiver is meant to pull gas, as distinguished from liquid?

A. Yes.

Q. What machine is that?

A. Gas producing machinery.

Q. I am talking of refrigerating apparatus, Mr. Witness.

A. You did not confine your question to that. You made a broad—

Q. Well, let's please understand each other: In refrigerating language, I tried to make the question, isn't the word "receiver" commonly used to mean a receptacle for condensed liquid refrigerant?

A. Yes.

Q. Now, in connection with the Evans patent: If I remember, you stated that this was not an atmospheric condenser because the air circulated within the outermost pipe around the innermost pipe. Is that what you said?

A. I did not state it, that fact for that reason, that I recall, that it was not what is known as an atmospherically cooled condenser, because the cooling agent is a forced stream of air through a fine double pipe as distinguished from the passage of air over the outside of the pipe, there being no other concentric pipe surrounding that which conveys the refrigerant.

Q. Now, I believe in your prima facie examination you differentiated between the Palmer reference to which I called your attention, and said that an atmospherically cooled condenser meant one where the air was not pre-cooled; do you remember making that statement?

A. I do not remember making that statement, but I will make it now, if you wish—not in the sense in which we are considering this patent of Wolf in suit.

Q. Well now, I call your attention to page 2 of the Evans patent, the sentence beginning line 47: "The air driven by the fan figure 12 may be used at its normal temperature, or it may be refrigerated before entering the condenser by driving it over an evaporating surface constantly moistened or in any other suitable manner. The mechanism may, however, be so constructed as to use air or water separately or both together."

Now, do you think that Evans discloses an atmospheric condenser in the sense that you use the term in your prima facie examination?

A. No. I think that he uses a special type of atmospherically cooled condenser. I would say that the forcing of the air at normal temperature through concentric pipe would effect a different result from what would be effected by blowing the air over an exposed pipe.

Q. Now, will you explain what you consider the operation of the device shown in figure 2 of the Evans patent?

A. That is described on page 2 at the bottom of the first column, where it says "Where the condenser is constructed without jacketed pipes, as in figure 2, the conveyor from the blower, 12, connects with air branches or stand pipes, 22, each arranged at opposite ends of the condensing coil and provided with numerous outlets, 23, directed inward. These pipes arise from a horizontal continuation, 24, of the conveyor, arranged beneath the condenser, and having its outlet, 23, pointing upward, air being thus driven from three different directions over the heated pipes of the cooler. The operation may be considerably expedited by placing a drip trough, 25, above, from which water is constantly sprinkled upon the pipes, 9, of the coil, the heat being rapidly absorbed by the moisture, and the refrigeration greatly accelerated by the rapid evaporation which is promoted by the thorough circulation of the air."

In this construction it appears that the refrigerant is passed through a single pipe instead of concentric pipes, although the ends of the pipe are shown the same in that figure as they are in the figure 1, small pipes projecting out of the large pipes, and the air is blown apparently from at least three sides of the condenser, blown from the blower against the coils of pipe, and water from the trough, 25, is allowed to drip upon the pipes.

Q. Do you notice the word "may" as regards the expediting by water?

A. Yes.

Q. Well now, consider an instance where the water is not dripped, but the air is forced from the stand-pipes on to the pipes carrying the refrigerant: Would that then fall under your classification of an atmospheric condenser?

A. I think so.

Q. Do you think that would be an operative device for compressing refrigerants in a refrigerating apparatus?

A. It might be under some circumstances. I think it could be made operative. The patent calls for the use of ammoniacal or other equivalent gases. If ammonia was used, I doubt the efficiency of the cooling device. Of course, these pipes that are shown in the Evans patent are large enough—they are of the same size in figure 2 as they are in figure 1; in figure 1 they are of sufficient size to encompass a pipe that is large enough to carry the refrigerant. They are very large diameter pipes of comparatively short length.

Q. Now, Mr. Sessions, you have been a patent attorney for many years, have you not?

A. What do you mean by a patent attorney?

Q. One who prepares and solicits patents.

A. I have been registered for practice before the patent office since 1910. I have prepared and solicited a number of patents, not many; I prepared my own applications largely.

Q. Now, do you usually find it a practice to use in a patent office drawing sizes and dimensions to make a completely operative device in all details?

A. Yes, if those sizes and dimensions are the critical things that determine the operation of the device.

Q. How many out of a hundred filed applications would that apply to, and I am speaking of the average?

A. As many as required that are prepared by competent attorneys.

Q. Now will you turn to the Martin and Beath patent again and see what attorney firm took out that one, if you know?

A. I think it is C. W. M. Smith; as I read it.

Q. Do you know the gentleman?

A. I do not.

Q. Turn to the claims, patent number 716091. Do you know that patent attorney firm?

A. Yes, I know Mr. Gifford.

Q. Would you say that was a competent patent attorney firm?

A. It has competent members.

Q. Now look at the drawing of that particular device. You have criticized it in many ways, namely as not showing sufficient apertures, or something, for the outlet of air. Now, do you believe as a patent attorney that there is sufficient information given in either the drawings or specifications or both for the securing of these letters patent.

Mr. Cooper: I object to that, that is not a competent question, the question of obtaining patents is not at issue here, but the question of what does the thing show and what does it stand for?

The Court: I think you are right in your objection, but I will over rule it.

Q. The question is—

Mr. Cooper: No, no, have the question read.

(Question read by the reporter.)

The Witness: Yes. The patent claims relate only to the means for forcing the air into the compartment, D, that is from some machinery into which the inventor desires to protect from dust.

Q. And is it or is it not a usual thing when you have described and shown the claimed portion of the case to then more or less diagrammatically illustrate the surrounding members?

A. That is the practice of some solicitors who do not have any particular interest in showing what the surrounding members are, if they are simply for background, but not to be included in the claims of the patent, they may be extremely loose, but one cannot determine from the showing what the apparatus actually was intended to be.

Q. Can you determine from the Martin and Beath apparatus what the showing was intended to be, and I am referring you now to the drawings and specifications combined?

A. Of any or all of them, what do you mean, the whole thing.

Q. Can you tell what the disclosure was intended to be?

A. I should say that the disclosure was intended to be such as to enable the inventor to get such claims as he has secured, allowed. It is not a disclosure in my opinion that would enable anyone skilled in the art to make any use of the device. He might take various things and put them together as defined in the claims, but to reproduce the machine from these drawings, would be a physical impossibility.

Q. Do you consider a patent should be reproduced from the drawings?

A. Not necessarily.

Q. You have criticized the Martin & Beath patent because I believe the drawings seem out of proportion. Just what do you mean by that statement? To make it a little clearer, how do you believe that damages the patent for the purposes which are assigned by the witness Van Deventer?

A. The purpose assigned by the witness Van Deventer was as I understand it, that it was a complete anticipation of the Wolf patent, and I believe I stated, and if I did not I will now state that as an engineer I could not take these drawings and this specification and arrive at a design such as the Wolf patent in suit shows and describes.

Q. Now let us go a little further. Why?

A. Because there is not enough in this patent to enable me to do it. No proportions are given, merely the arrangement of the various elements that are combined in the claim, which are not the elements that are found in the Wolf patent.

Q. Now what elements of the Wolf claims in this suit do you not find in the Martin and Beath patent?

A. I do not find an atmospherically cooled condenser in the Martin and Beath patent, I do not find a coil composed of a considerable length of copper tubing of substantially ⅜ inch diameter. I do not find a condenser having an air cooled condenser composed of a considerable length of metal tubing of not more than a half inch in diameter, and having a comparatively thin wall. I do not find an atmospherically cooled condenser means, and a fan mounted to effect a circulation of air around the condenser and against the compressor, or around the condenser and driven by a motor. I find no motor in the Martin and Beath patents. I find no atmospherically cooled condenser means and a fan mounted to rotate about an axis parallel to the motor and driven thereby to effect a circulation of air around the said means. I do not find a refrigerating apparatus, a household refrigerating apparatus, or any kind of refrigerating apparatus, for that matter, including means to compress a refrigerating gas, and a pressure, the corresponding boiling point of which is above the temperature of the atmosphere—that is, I do not necessarily find that. If the cooling water be of lower temperature this cooling means employed would permit the compression of the refrigerant to a pressure, the corresponding temperature of which was not above the temperature of the surrounding atmosphere—the boiling point of which was not above the temperature of the surrounding atmosphere.

Q. Now we will take in order at least a few of those reasons. You say you do not find an atmospherically cooled condenser?

A. An atmospherically cooled condenser, no.

Q. The reason you say that is because in addition to the air a sprinkle of water is used from the member, small (b)?

A. Yes.

Q. Now, the difference in the dimensions of the condenser tubes, ⅜ or ½, are in the disclaimers, are they not?

A. Yes.

Q. Now regarding the motor, how do you regard the fan, E, I guess it is, to be driven?

A. From some prime mover.

Q. That might be a motor?

A. That might be a motor, yes.

Q. Now regarding the refrigerant with the various boiling points, in relation to the atmospheric temperature, is that substantially the same reason,—or do you have substantially the same reason for making your statement of difference, as was assigned in the file wrapper of the Wolf application, or have you some special reason that you would like to state now?

Mr. Cooper: I don't know that the witness has seen the file wrapper. I haven't asked him anything about it. I have asked him to state his reason. Ask him his reason.

The Witness: I have never read the file wrapper of the Wolf patent.

Q. Then let us find out why you make the assertion of difference with relation to the boiling point of refrigerants and atmospheric temperature relations.

A. For this reason, that there is nothing in this Martin and Beath patent other than the kind of refrigerant that is used, ammonia, to indicate that the pressure to which the compressor compresses the ammonia gas was one at which the corresponding boiling point would be above the temperature of the atmosphere. In fact the compressor that is shown is such a crude thing that one might suspect it was not intended to compress the—

Q. Well let us see if we can get to the question, if possible, without ramifying. You have told about the drawing proposition—

The Witness: If you will pardon me, I should like to complete my answer. I had not completed it, to your last question.

The Court: I will permit that.

(Answer read by the reporter as far as given.)

The Witness (Continuing): That it was not intended to compress the gas to a very high pressure.

Q. Now, have you finished?

A. Yes.

Q. Now will you turn to page 3, second column, the paragraph beginning: "In our apparatus." Have you read that paragraph before making that statement?

A. Yes.

Q. Well, what volatile fluid whose tension of vapor amounts to a few inches of mercury at the freezing point of water, does not have a boiling point at the points that you have mentioned? Will you tell us of one or more?

Boiling points of various refrigerants at given pressures and temperatures.

A. I find by consulting this chart that gives the boiling points of various refrigerants at given pressures, and temperatures, that at 32 degrees Fahrenheit the pressure at which ammonia boils is about 48 pounds gauge pressure, methyl chloride about 22, sulphur dioxide—insolutane, about 8—then there is butane which appears to be right on the line of zero pressure, and ethyl chloride, and ethyl ether that are a few pounds below atmospheric pressure. This tension of vapor amounts to a few inches of mercury—understand that is a few inches of mercury vacuum, I don't know whether that is above the atmospheric pressure or below the atmosphere.

Q. Do you think that is a fair answer to the question as related to that paragraph: "A volatile fluid whose tension of vapor amounts to a few inches of mercury at the freezing point of water."

A. That is all the point 32 degrees Fahrenheit comes into play on, that it is a few inches of mercury at that point.

Q. Now he says: "Having selected our fluid we ascertained from standard authority on the subject its latent heat, the specific heat that is evaporated, also the tension and volume of its vapor at different temperatures from which we are enabled to calculate the amount of cold produced by the vaporization of a given quantity of liquid; the pressure required to condense it, and the volume of air required to remove the heat evolved by this condensation, usually allowing the air to be raised in temperature three or four degrees, and the water which goes with it in the form of vapor to absorb and carry away one-fourth of the whole amount of heat to be removed. Do you still want to say that these various refrigerants you have read will not fall within the terms that have been specified in such great fullness in the Martin and Beath specifications?

A. No, I have not so stated.

Q. Now don't try to see what they are at 32 degrees Fahrenheit, please let me know if you know of any which at 32 degrees Fahrenheit have a tension of vapor amounting to a few inches of mercury, and even when used in refrigerating apparatus at the ordinary pressures of such refrigerants, would not fall under the terms of the claims that you stated as the difference, quoting from claim 10 of the patent in suit?

A. I cannot answer the question, it is too hypothetical, I cannot follow it.

Q. Well let us see, you remember on your prima facie examination that you made the statement that practically all refrigerants fell within the terms of that quoted portion of claim 10. Do you want to correct that now?

A. No.

Q. Then why, in relation to the Martin and Beath do you say that he cannot use one to accomplish what he says he accomplished in his specifications?

A. It is possible that he might use one that would accomplish what he says, but your first question that brought about this discussion was regarding the apparatus, and I still claim that the apparatus is so crudely shown that one would not be able to determine how to make it.

Q. Do you still claim you should interpret a patent from the drawings only without regard to the reading matter such as I have quoted herein?

A. I have never claimed it.

Q. Then why continually refer to the drawings. Couldn't you take from this particular quoted portion and select a refrigerant and make the calculations as he has stated?

Mr. Cooper: Do you mean today or in 1872?

Mr. Frye: He stated he could not to it today as I remember it.

The Witness: Well, will you deprive me of looking at the drawings as well as the specifications?

Q. To pick a refrigerant, if you need a drawing, go ahead and look at it.

Mr. Cooper: What is the question?

Mr. Frye: The question is can he pick a refrigerant from the description.

The Witness: The statement made upon page 3 is of absolutely no value without considering the apparatus that has to be used, and I will say definitely that no engineer, without considering the apparatus that is to be used, could select or could choose—could ascertain from a standard authority or of those various things and do all the things that he says he proposes to do or does do. He has selected the fluid in this paragraph you have read, he says: "Having selected our fluid we ascertain from standard authority on the subject its latent heat."

I should say it would be well to determine the latent heat before selecting the fluid.

"The specific heat that is evaporated, also the tension and volume of its vapor at different temperatures, from which we are enabled to calculate the amount of cold produced by the vapors with a given quantity of liquid."

That would mean that saturation tables for the particular vapor that was to be used. I don't know whether such tables were available at that time in this patent or not.

Q. Well, do you mean to intimate that the gentleman making the statement under oath in his patent, didn't know what he was talking about?

Mr. Cooper: I object to that as incompetent, if your Honor please, he cannot intimate anything. The question is one of facts.

Mr. Frye: Well, I don't know whether it is lack of knowledge or whether he means the gentleman here did not know.

Mr. Cooper: I object to the form of the question and to this character of examination.

The Court: I don't believe the answer would help any.

Q. Well, let us go on to the apparatus with which we have particular interest in this suit, and I would call your attention to the sentence beginning, the third from the last line on page 3: "Therefore, the aggregate sectional area of the pipes in either the congealer or condenser should be sufficient to convey the gas or vapor at a velocity not exceeding 16 feet per second at any point in its course." Would that enable you, as an engineer, to pick the size for your condenser pipes?

A. That is a rule that I presume was laid down by this inventor, that is fixing you might say a diminution or a factor in the machine of 16 feet per second at any point.

The Court: Does Wolf with the disclaimer conform to that requirement?

The Witness: I understood Mr. King to say that Frigidaire uses a velocity of substantially a thousand feet, not to exceed that, but Wolf does not necessarily place that limitation upon the velocity of the gas.

The Court: I take it the question is not the only way of getting at the proper dimensions of pipe, both for condenser and expansion pipes.

The Witness: I don't see how it would enable one to determine whether a large pipe or a small pipe should be used.

The Court: If you increase the size of these pipes you decrease the flow through them, would you not, if you leave everything else the same in Frigidaire except if you double the size of the pipes you greatly decrease the flow through them.

The Witness: The velocity?

The Court: Yes.

The Witness: Yes, you would.

The Court: So you would have to change other things to make it conform?

The Witness: Yes, and if you had different capacities of compressors, your velocities for the same size pipe would vary greatly.

Q. Suppose you reduced a pipe, condenser pipe, for example, from 1 inch diameter to ½ inch diameter, other things being equal, that would speed up the velocity or flow of the gas, would it not?

A. If you transmitted the same amount of gas through.

Q. Yes, I said everything else being the same.

A. Yes.

Q. That remains true, does it not, until you get down to a pipe so small that the skin friction forms too great an impediment to the flow of gas?

A. If your first assumption is followed, it would not make any difference if you transmitted the same amount of gas in the same time then the velocity keeps on. You could not do it though, on account of friction.

The Court: If you get too small a pipe.

Q. Do you personally know where that too small pipe is used in refrigerant gases?

A. No.

Q. Suppose you had the information before you that you should not use a velocity flow of gas greater than 16 feet a second, that is 960 feet a minute, and you wanted to design a condenser to carry a certain amount of gas sufficient to do what you would term a small amount of work in refrigerating capacity, for example, 100 pounds per day, do you think you could design such a condenser?

A. May I have the question read?

(Question read by the reporter.)

The Witness: As I understand your question, the only limitation I am to consider is the velocity of gas at 16 feet a second, is that correct?

Q. Well, you know that you are not to go beyond that. Now, I say, with that knowledge could you design a condenser?

The Witness: Now, today?

Q. Well, let us say today, could you do it today?

A. I think so.

Q. Well, do you think you could have done it that day after you read this particular specification?

A. Well, I could have designed a condenser in which the velocity of the gas would be within the limitation that you say, but as to whether it would be a successful condenser for atmospheric cooling or not, I do not know.

Q. Well, has anyone asked that question. I wish you would hew to the line, as your counsel has asked me to do.

A. I think I have a right to explain my answers.

Q. Well, you certainly have exercised the right. Now let us get back a little further. Suppose you designed one and it had an outside diameter of two inches, and you found it was impracticable, as you have expressed it, what would you do toward making it more practical or more successful as a mechanical engineer?

A. Try again.

Q. Do you think you would reduce the diameter of the pipe?

A. I might.

Q. Do you think you would have before 1913?

A. If I felt that was the direction in which to go.

Q. How would you determine whether or not that was the direction in which to go?

A. By testing.

Q. Now, carrying it a little further, suppose you found that when you used a one inch pipe and it did not work sufficiently, satisfactorily, do you think you would carry on your tests until you found a smaller pipe, or would you reverse and go backwards on it?

A. If I were set on making a tubular condenser using a single tube, I would endeavor to use my best judgment as to which way to go whether to go up or down.

The Court: Would there be some things that would indicate whether you would go up or down?

The Witness: If on testing with a two inch pipe we found that it took up too much space we would attempt to make one with a smaller pipe, and if we found we could get it into a more compact space we might find it would not cool the fluid, and might find that by taking a 2½ or 3 inch pipe, or making some special form of condenser, heating radiator type of that sort, that Mr. Frye presented to me this afternoon, I might try to see how to get a compact condenser, so I don't know how just to go at the matter of determining the proper form of condenser in order to get the most compact and efficient, and that is a matter of cutting and trying, or reasoning out some form and making it and testing it.

Q. Now the original question—at the 100 pound capacity do you think a 2 inch pipe and condenser would be a reasonable one for a mechanical engineer to make in a device of that kind?

The witness is embarrassed

The Witness: If your Honor please, I am very much embarrassed because of my familiarity with this modern machine, that using of small tubes affects my judgment, so that I cannot answer in any other way. I now think that a 2 inch pipe would be vastly too large, I should go down to ⅝ pipe, the ⅜ pipe of Wolf, that is the way I would do it today.

Q. Why the ⅜?

A. Because Wolf teaches it, and because it is used universally in most of this machinery I have inspected of plaintiff's and defendant's. It must be satisfactory. It is operating in thousands and hundreds of thousands of machines.

Q. Are you going to add any more?

A. Is your question answered?

Q. I don't think it has ever been answered, you just volunteered a group of statements. You volunteered it must be successful because of certain things. Do you know whether the Domelre machine was a success?

A. I don't know.

Q. Do you know that Mr. Wolf, the inventor, made the Domelre machine?

A. I don't know it, I haven't any knowledge of it.

Q. Do you know the Isko company made the Domelre machine in substantial duplication?

A. I have no personal knowledge of it.

Q. Do you know whether the Isko company made the devices of the Wolf patent?

A. No, I have no personal knowledge of it.

Q. Now, it is still your contention after reading the Martin and Beath to sum this up, that you do not have sufficient information, that, without reading the Wolf patent, you could design a condenser having 100 pound capacity, is that what we should understand you as saying? Maybe I confuse you by asking you how you do it today—

The Witness: Just a moment, you have asked me one question, and do you wish me to answer it or to switch on another subject?

Q. Well, let us go at it to shorten the time. Maybe your answers were given in the idea of what you would do today. Let us assume there was no Wolf patent prior to 1913 and you had the Martin and Beath disclosure before you, and it must not exceed 16 feet per second, and you wanted to design a relatively small refrigerating apparatus, as, for example, 100 pounds a day capacity, do you think you could design a condenser, and I mean a successful and operative one of course?

Mr. Cooper: You mean from the data in the patent alone?

Mr. Frye: Exactly—not alone, but what he would have before him in 1913.

A. No, I have not found in any of these patents, sufficient information and data to enable me to design such a condenser for that size machine.

Q. Did you ever design a condenser for any kind of refrigerating apparatus?

A. No.

Q. Do you know how to figure the relative cooling capacity of air and water in condensers?

A. What types of condensers?

Q. Is it necessary to know that to figure the relative cooling qualities of it?

A. It certainly is.

Q. You don't think that you could mathematically compute how many B. T. U.'s are taken out with a pound of water and how much with a pound of air, and compare them, is that true?

A. I can determine from tables that have been available for years, the B. T. U.'s that will be absorbed by water and air, but the conditions under which they absorb the B. T. U.'s make it—must be known before you can determine how much will actually be accomplished.

Q. Do you believe the evaporation of a pound of water will take more B. T. U.'s under circumstances or a set of circumstances than in another, is that what you have been trying to say?

A. I have not been trying to say it. Do you wish me to consider that question?

Q. Yes.

A. Water under certain pressure requires a certain amount of heat to evaporate it, under another pressure it requires another amount of heat.

Q. Let us assume a figure, say a condensing temperature of 80 degrees. Do you need any other figure for it?

A. May I hear the whole question?

Q. How can you compute the relative capacity for cooling one pound of water to one pound of air at 80 degrees temperature?

A. It cannot be computed without knowing the conditions of use both for air and the water.

Q. Do you know how to figure the velocity of gas in feet per second or per minute in refrigerating apparatus?

A. Yes.

Q. How do you do that?

A. Find the volume of the gas and find the length of the stream, and the size of the pipe or condenser through which it is going.

Q. Do you need the pressure as a constituent part?

A. No, you speak of velocity.

Q. Is velocity the same at all pressures?

A. You are getting into an entirely different state now. What—

Final Cross Examination by Council for the Plaintiff

Q. I am asking you whether it makes any difference whether the pressure is constant or whether you need that in as your factor?

A. I don't understand your question. Pressure and velocity are two different things, velocity is a rate of travel, pressure is the force that may cause the travel.

Q. Does one affect the other in refrigerating apparatus?

A. Pressure affects velocity.

Q. Does velocity affect pressure, is it something that is usual, or is it a special instance where you have to figure pressure?

A. If you have a given velocity of gas, it is a very easy matter to determine the size of the pipe that will conduct it at that velocity to give it—to deliver a certain quantity of gas in a certain time. Is that what you are driving at or asking for?

Q. That is a very easy matter, I should think you could compute it, but you have answered it, I believe, once that you cannot compute it from the information of the Martin & Beath patent.

A. Cannot compute what? Velocity of gas?

Q. No, you say it is an easy matter to compute the size of the pipes, I think that is what you said, and if you did not intend so let us correct it.

A. These questions are all mixed up, they haven't any relation to each other, and it is impossible for me to determine what the question refers to.

Mr. Frye: Will you read that answer back there where he refers to that, and says that it is perfectly easy.

(Answer read by reporter as follows: "If you have a given velocity of gas it is a very easy matter to determine the size of the pipe that will conduct it at that velocity to give it—to deliver a certain quantity of gas in a certain time.")

The Witness: That answer is perfectly correct.

The Court: Given the number of cubic feet you want to keep cool, can you tell how much heat you have got to take out of there in a given time?

The Witness: Yes, sir.

The Court: And then knowing how much heat you want to remove from a certain chamber in a certain ice box, and knowing the kind of a refrigerant you want to use to remove that heat, cannot you determine the amount of it?

The Witness: The amount of the refrigerant.

The Court: Yes.

The Witness: Yes, I think so.

The Court: Then, having determined it, if you knew the rate of speed would not that determine the size of the—

The Witness: The size of the pipe that would give you that velocity?

The Court: Yes.

The Witness: Yes, sir.

Q. Do you know who owns the Coleman patents to which you referred, to-wit, numbers 709814 and 1014120?

A. I do not.

Q. Did you ever know they were owned by the plaintiff in this suit?

Mr. Cooper: I object to that form of question. One of these patents ran out in 1919 before this plaintiff was—

The Witness: Well, the witness said he does not know, so that disposes of it.

Q. Now, looking at the disclosure of the two Coleman patents did you answer on your direct examination whether the condensers were air cooled?

Mr. Cooper: I think he did answer it, that is my recollection.

Q. Did you say, that, and if so we won't go into it?

A. I should have said had I been asked, and I will say now.

Examination on machine construction to test the Birk patent.

Q. In this machine you constructed for testing the Birk patents, when was this test made?

A. Some time last fall, I believe, October or November.

Q. You said that was S02, I believe. What lubricant did you attempt to use?

A. It was the same lubricant that is used standard with the Frigidaire Corporation, I don't know what it is. It is a petroleum oil.

Q. I think you said it worked about five weeks and then got noisy?

A. No, it burned out the motor and went to pieces.

Q. At the end of five weeks?

A. A few weeks.

Q. Then you tried it again and after a few weeks it became noisy, is that what you said?

A. Yes, that is what I said.

The Court: Have you an opinion whether or not that would be successfully operative with a refrigerant that was a conveyor of lubricant?

A. I don't know, your Honor, whether it would or not. I seriously question it.

The Court: As I have interpreted your experiment from what you said, that seemed to be the only trouble you had, but maybe I didn't get it right.

The Witness: I will show you the reason why on the drawings of the Birk patent. The refrigerant condenses and flows down into the evaporator and stands in there at a certain level boiling—

The Court: The lubricant?

The Witness: The lubricant—the refrigerant and the lubricant on top of it. The outlet from this tank is away above the center of the tank, the one that comes back to the compressor, and the level of the refrigerant never gets anywhere near that high in this boiler, so that the only thing that would take the oil over would be the carrying of the oil in bubbles of gas, and I don't know of any gas or any lubricant that has that viscosity that would be carried over.

Q. Is there some way to raise the level of that without serious trouble?

A. It would require a vast quantity of oil, and you cannot use more than a certain limited amount of oil in your compressor or you would flood it.

The Court: What would happen if you increased the amount of lubricant?

The Witness: It would simply draw so much oil into the compressor that it would just carry it over so much faster.

The Court: What I thought that was designed to do, would be high enough so it would flow out there at the surface, the lubricant, or is not that possible or practical?

The Witness: Well, if it did that you would have to put the same kind of a device of a sort that the plaintiff has here that takes the oil off the top.

The Court: But there is no such scheme in that?

The Witness: There is no such scheme in that.

The Court: So when you mean a conveyor of lubricant you mean in the evaporator.

The Witness: Yes, sir.

Q. Have you never heard that methyl chloride is a conveyor of lubricant?

A. I have never heard it. Methyl chloride is a gas.

Q. As a refrigerant?

A. As a gas or liquid?

Q. Well, I presume it is in both, in a refrigerating apparatus, I am asking you?

A. Well, I don't know.

Q. I believe you answered that you never did?

A. I cannot answer without you telling me which.

Q. I asked you if you ever heard of it as either?

A. No, I have never heard of it.

The Court: In order to be a conveyor of a lubricant it means that the lubricant will mix with the conveyor.

The Witness: With the conveyor, yes.

The Court: Like if we put sometimes lubricant with the gasoline, that is what you mean, isn't it, in that sort of way?

The Witness: Yes, sir; but water will not.

The Court: In the gasoline I can put some engine oil.

The Witness: Yes, sir.

The Court: And that is what you mean?

The Witness: Yes.

Mr. Cooper: That is all, and that is our case but for one thing. Both sides have been referring as a matter of convenience to these curves on the question of temperature, and I would like to have it marked exhibit 48.

(Chart marked exhibit 48.)

(Intermission.)

Harry C. Hayes recalled as a witness for the Defendant.

HARRY C. HAYES was thereupon recalled as a witness by the defendant in sur-rebuttal, and having been previously sworn, testified further as follows:

Examination

By Mr. Frye:

Q. You are the same Harry C. Hayes who has been previously called?

A. I am.

Q. I call your attention to the construction shown in the French patent to Birk, No. 451705, and ask if you, as an experienced refrigerating engineer, believe that that is an operative structure?

Mr. Cooper: I will object to that if your honor please. That is not proper surrebuttal. They brought this in, they put in their evidence, and I do not think it is a proper ground for re-opening because they want to call another witness on the same thing.

The Court: You probably are right about that, but I will let both sides get all the testimony in. I am not very strict about that.

Mr. Frye: I say it is raised—

The Court: I will admit it.

A. I not only think it will work, but I have built big plants which are still operating on the principle laid down in this, namely, a shell condenser and a shell evaporator. I can name you several such plants in Detroit. They not only have worked for long years, but I anticipate they will continue to work. These plants use ammonia, which is not a conveyor of refrigerant.

Q. You mean refrigerant?

A. I mean of oil, lubricant; but the lubricant in those cases is fed directly into the compressor.

I also have built little methyl chloride machines working on that principle, and they worked perfectly, simply because the methyl chloride is a thing that will dissolve that oil, I should say lubricant, and will carry it either when that methyl is in the form of a liquid or the form of a vapor.

Mr. Frye: Take the witness.

Cross-Examination

By Mr. Cooper:

Q. Well, now these large machines were ammonia water-cooled jobs, weren't they?

A. Yes, sir, in the summer time; and in the winter many of them are air-cooled.

Q. As you described the other day, in winter the output of a machine is so small that the condensing area is not all used. That is it, isn't it?

A. That is about what—

Q. Yes. Now you spoke of them being —of the little methyl chloride machines. Is that something of an experimental or demonstrating nature?

A. Not at all. We have used them in apartment house work, which is a flooded proposition, an evaporator of this kind, thousands of them.

Q. Thousands of them—just like this, just like the drawings on this?

A. Certainly not in drawings, but the exact principle, I said.

Q. Oh, on the refrigerating cycle principle the same as this?

A. No, on the exact principle laid down here; not only refrigerating cycle, but the shell evaporator and a shell and tube condenser.

The Court: Just show me that shell.

The Witness: For instance, in counter work, your Honor; in cooling a refrigerated counter, they put an evaporator in about this shape, sometimes put fins just like this, feed the liquid into it and take the gas out. For air-cooled condenser that is also a—

The Court: By the shell you don't mean the small tubes inside of the big one?

The Witness: We have done that in the bigger stuff.

The Court: But you still call it a shell when it is like a small tank?

The Witness: No, we make those; we have made those water cooled too, having a shell proposition cooled with water.

The Court: Anything inside the shell besides the refrigerant?

The Witness: Yes, sometimes there is a little water coil in there.

The Court: Always, necessarily?

The Witness: If you cool it by water.

The Court: But if you cool it by air?

The Witness: It would not be necessary; just a big shell, big enough, just like this.

The Court: Put on fins?

The Witness: Put on fins, make it work perfectly.

Q. I understand you have done it.

A. In the small stuff, you mean?

Q. Yes.

A. Well, the condenser does not look just like this, if that is what you mean. It does not look just like that.

The Court: I had in mind a shell with fins on it, cooled by air.

The Witness: Not a shell; no, sir, not in the condenser.

Q. Well, now, in those ammonia jobs which you mention, the lubricant does not go over with the ammonia, it is separated out, isn't it?

A. They have what they call an oil trap on there, to endeavor to separate it, but as a matter of fact, a great deal of it does go, but we don't count on it.

Q. But the effect of lubrication is what doesn't go, isn't it, what is taken off?

A. No, that does not have anything to do with it. In a big ammonia job you feed just what lubricants you need into the compressor, then you attempt to separate that oil from the ammonia gas before the gas goes to the condenser.

The Court: In what way?

The Witness: They have a trap in there that we call an oil separator or an oil trap.

Q. If the oil goes over in the ammonia machine, it has to be separated out, doesn't it?

A. It will surely go. We try to keep it from going, but it does go.

The Court: It will have to be separated out?

The Witness: No, we try to get it, but don't do it all.

The Court: If they don't do it, what happens?

The Witness: It is apt to lie in the evaporator and gradually render the evaporator not quite so efficient as it was.

The Court: I probably ought not to ask this question, but will you explain how that misfortune came to his apparatus there?

Hayes explains what went wrong in the experimental machine mentioned by Sessions.

The Witness: Yes, I will be glad to give my idea of it. I did not see the test, but here is what happened: he fed in sulphur dioxide into the evaporator, and sulphur dioxide is a thing that does not mix with the oil to any great extent. The oil lay on top—

The Court: In the—

The Witness: In the evaporator.

The Court: That is, in the condenser?

The Witness: No, it is in the low side.

The Court: That is the cold part.

The Witness: The oil gradually found its way up through the gas, went out of his compressor—went through the condenser down into the low temperature, and then after while they had all the oil out of the compressor and had made no arrangement for its return, so of course, the compressor burned up eventually.

The Court: He said it destroyed his—what was it he said?

Mr. Cooper: It destroyed the bearings on the compressor.

The Witness: That is exactly what it would do.

Mr. Cooper: There is no difference between the two explanations.

The Witness: He started off with a certain level of oil in the compressor, in the crank case of the compressor; the crank splashing around in that gradually, in a mechanical way, threw the oil out in a fine mist a little at a time until it passed out with the gas; it came into the condenser where the refrigerant was condensed—

The Court: On top of it?

The Witness: Well, it was after the condensation took place, ran down into the evaporator, where the oil, because of the difference in gravities of the refrigerant and the oil, floated on top of the refrigerant—sulphur dioxide is a very heavy liquid.

The Court: This is the refrigerator part of it?

The Witness: Yes.

The Court: There would not be any liquid down in there, would there?

The Witness: Yes, under his scheme of operation there would be a certain amount of liquid.

The Court: I thought you had a liquid in the condenser.

The Witness: No, don't you remember, I showed on that diagram there was a certain amount of liquid?

The Court: Yes, that is right.

The Witness (continuing): And, therefore, that occurs too in the plaintiff's device here, oil does float on the surface here, but they provide a means to take it back; and they did not attempt to make such a provision here.

Mr. Cooper: That is, in Birk.

The Court: How do you get liquid in your refrigerant under that low pressure?

The Witness: Well, it is lubricant that is made particularly for this kind of work, and will not congeal.

The Court: I think you showed me there, it was your refrigerator, wasn't it, that you had some liquid down at the bottom of the evaporator?

The Witness: Evaporator or condenser. Which does your Honor speak of?

The Court: I know you had it in the condenser, but didn't you have any liquid in the evaporator?

The Witness: Yes, sir.

The Court: But how could you have liquid in there at such a low temperature?

The Witness: Don't you remember, your Honor? I showed you how liquid lay in the test tube.

The Court: That is right. Like water in a teapot when it is boiling.

The Witness: It is the same analogy absolutely.

The Court: It does not all go out.

The Witness: Correct.

Q. In this Birk patent there is no provision for taking off the lubricant after the refrigerant has left it behind in the lower chamber there?

A. It would not need it either.

Q. No, just answer my question: I say, there is no provision there for taking the oil off.

A. I do not see any such provision.

Mr. Cooper: No; that is all.

Mr. Frye: That is all.

The Court: Now, is that all? I will hear anything that either one of you want to offer yet. I am looking for help all the while. You are both fully satisfied with the opportunity you have had of putting in proof, as I understand it?

Mr. Cooper: Oh, yes, I think we have a case here.

Mr. Frye: There is something we might want to offer that is not available.

The Court: Does this record show anything about how well these things worked that were made by plaintiff's predecessor entitled to the patent?

Mr. Cooper: No, I think not.

The Court: Neither one of you have gone into that, have you?

Mr. Cooper: Except to the extent that Mr. King, the witness this morning, spoke of some Isko refrigerators that were in Dayton there for a number of years, that he said worked well, and he said one of them had a coil destroyed or partly destroyed, and the owner being an acquaintance of his, asked him to come down and patch up the coil, and it went on running again.

The Court: Does this record show very clearly how well these other things that were made, actually made along in the early days here—they produced an awful lot of catalogs here which we looked at?

Mr. Frye: That will be in the argument tomorrow, your Honor.

The Court: But as to the machine and what it did, there is not much about that, is there?

Mr. Frye: Well, the Domelre machine, as I understand it, is in the record, and the Isko machine is the one that was bought by the plaintiff, and the record of the transfer, including the Wolf patent, is in the record.

The Court: There is not any of these old machines anywhere around here to look at.

Mr. Frye: I don't think there is any of them in existence as far as we know.

Mr. Cooper: Except to the extent that Mr. King said there was—

Mr. Frye: He did not say whether they were air cooled, and Isko made both.

Mr. Cooper: I think I differ with you on what he said there.

The Court: Who is Isko?

Mr. Frye: Isko is the one who succeeded Domelre and Delco succeeded Isko and Frigidaire succeeded Delco. That is the chain—

The Court: That is the chain.

Is there anything further?

All right—well, then, we will adjourn until tomorrow morning at nine o'clock.

(Whereupon adjournment was had until Saturday, March 23rd, at nine o'clock, a. m.)

This completes the proceedings of the fifth day of the trial. On the following day (Saturday), Judge Tuttle handed down his opinion in which he declared the Wolf patent invalid, rendering a decision in favor of the defendant (General Necessities Corp.) The opinion of the Court was printed in full in the March 27 issue of the News and will be reprinted with corrections in the supplement giving the complete record of the trial. Extra copies of the Supplement may be obtained by sending remittance to Electric Refrigeration News, 550 Maccabees Bldg., Detroit, Mich. Price $1.00 per copy postpaid.

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